3.2 WATER QUALITY

This section describes existing water quality conditions and potential water quality impacts to the Sacramento/San Joaquin River Delta, Big Break, Dutch Slough, Marsh Creek, Emerson Slough, Little Dutch Slough, Contra Costa Canal (collectively referred to as "Surface Waters"), and groundwater for the proposed Dutch Slough Restoration Project and Related Projects. Processes and other factors affecting water quality conditions and existing water quality data are described to provide a baseline for environmental review. Contamination history of the Dutch Slough Restoration Project and Related Projects sites also is summarized. The regulatory framework provides an overview of federal, state and local regulations protecting water quality. Finally, known and potential impacts to water quality are described, as are mitigation measures to prevent and compensate for impacts.

3.2.1. Affected Environment

Water Quality Background

Water quality in the Project area is governed by both natural conditions and human land use. Local areas drain a mix of open space, rural and suburban landscapes to Marsh Creek, Emerson, Little Dutch and Dutch Sloughs, and the Sacramento/San Joaquin Delta. The net flow of water in the San Joaquin and Sacramento Rivers is downstream; however, incoming tides can transport water and its constituents into the project area as well as into the Contra Costa Canal. Chemical, physical, and biological water quality parameters are affected by land use and both human and natural processes.

The Marsh Creek watershed transports runoff from the undeveloped lands on the north-east side of Mt. Diablo as well as the rapidly urbanizing areas of Brentwood and Oakley. Contaminants from these areas are transported via the Marsh Creek flood control channel to the Delta at Big Break. Runoff from an abandon mercury mine site in the upper watershed is also a potential problem because it could lead to unhealthy concentrations of mercury in organisms in the Delta and at Dutch Slough and Marsh Creek. The Marsh Creek Dam forms the Marsh Creek Reservoir, located approximately 10.5 miles upstream of Big Break. The reservoir acts as a sediment sink, capturing runoff from much of the watershed including that from the historic mercury mine located well upstream of the reservoir.

Agricultural areas in the Marsh Creek watershed are being converted to suburban uses resulting in increased impervious surfaces and reduced infiltration of rainfall and runoff into the ground. As a result, natural filtration processes are decreased and pollutants are transported more directly to surface waters and increased erosion into these surface waters can occur, especially where vegetation has been degraded or removed. Increased erosion can, in turn, lead to increased turbidity and nutrients, while reduced shade from vegetation impacts can increase water temperature, lower pH, and increase biological oxygen demand. Remaining agricultural landscapes provide greater rainfall and runoff infiltration than developed areas but continue to be a source of fertilizers, pesticides, nutrients and other pollutants, including high concentrations of dissolved organic carbon that can contribute to the formation of chlorination by-products known as trihalomethanes.

Municipal wastewater discharges from the Brentwood Waste Water Treatment Plant into Marsh Creek are a potential source of pollutants, including endocrine disrupting chemicals that can have biological impacts that are not fully understood. The Ironhouse Sanitary District has discharged treated wastewater to Ironhouse Project lands and ISD lands adjacent to Marsh Creek and Dutch Slough for nearly 30 years, potentially increasing concentrations of endocrine disrupting chemicals, metals, and other pollutants to groundwater and surface waters in the Project site. In particular, treated wastewater has been used for irrigation on the Ironhouse parcel.

CONTAMINANT FLOWS OF POTENTIAL CONCERN IN THE MARSH CREEK WATERSHED

MERCURY

Mercury is a naturally occurring element that can be found throughout the Bay-Delta environment. Human activities such as mining, burning coal and using mercury to manufacture certain products and historical use in the 19th century Sierra Nevada gold mining industry, have increased the amount of mercury in many parts of the environment including the atmosphere, lakes, streams, rivers, and estuaries. The mining of mercury primarily in coastal mountain ranges and the use of mercury in gold mining in the Sierra Nevada have released large quantities of the metal to the environment of California since the mid 1800s (Alpers and Hunerlach 2000).

Concerns about mercury pollution stem largely from the potential adverse effects of dietary exposure to methylmercury (MeHg), a highly toxic form that readily accumulates in biota and can biomagnify to harmful concentrations in organisms atop aquatic food webs including larger fish and piscivorous birds (Mahaffey 2000, Clarkson 2002, Wiener et al. 2003). Nearly all of the mercury in fish is MeHg (Grieb et al. 1990, Bloom 1992), and consumption of fish is the primary modern pathway of MeHg exposure in humans (NRC Committee on the Toxicological Effects of MeHg 2000, Mahaffey 2000, Clarkson 2002, Schober et al. 2003). Concentrations of MeHg in food webs supporting production of fish and aquatic wildlife are strongly correlated with the supply of MeHg (Hecky et al. 1991, Kelly et al. 1997, Gilmour et al. 1998, Paterson et al. 1998, Heyes et al. 2000, Wiener et al. 2003).

Inorganic mercury is converted to MeHg by microbial activity, but the actual physical, chemical, and environmental factors controlling methylation (conversion to MeHg) and demethylation (conversion to inorganic mercury) are poorly understood. The restoration of wetlands, particularly in areas where the abundance of mercury in soils or sediments has been elevated by mining or other human activities, could accelerate the production of MeHg and increase the contamination of aquatic biota (Naimo et al. 2000, Wiener and Shields 2000). In addition, flooding of vegetated wetlands or uplands or fluctuating water levels during tidal cycles could stimulate microbial methylation of inorganic mercury, increasing concentrations of MeHg in water and biota (Hecky et al. 1991, Hall et al. 1997, Paterson et al. 1998, Bodaly and Fudge 1999, Hall et al. *in press*).

Due to the concern that wetland restoration could increase MeHg levels in the Delta, the CALFED Bay-Delta program initiated a multiyear research program to determine where MeHg levels are highest and identify when and how mercury is converted into MeHg in the Bay-Delta. Initial results of the research program were presented at the 2006 CALFED Science Conference and indicate that:

1. MeHg levels in fish are highest in San Francisco Bay and on the perimeter of the Delta where upstream rivers and flood bypasses enter the Delta. MeHg levels in fish are lowest in the central and western Delta near the Dutch Slough project.
2. Some wetland environments, particularly floodplains, appear to be a source of MeHg while other wetlands such as freshwater emergent tidal marsh appear to be a sink for MeHg.
3. MeHg fluxes onto and off of tidal wetlands appear to vary substantially over tide cycles and seasons. Export from tidal wetlands is probably greatest on extreme ebb tides when the wetland substantially drains.

4. Methylation rates vary between types of wetlands and in different parts of the Bay-Delta. They appear to be highest on floodplains and high salt-marsh plains that are episodically or periodically inundated and drained. Methylation rates are substantially lower in and along the edge of tidal sloughs, in open water, and freshwater emergent marsh where short-duration wetting-drying cycles are not found. Some of these latter environments may be locations of demethylation.

MERCURY IN THE MARSH CREEK WATERSHED

An abandoned mercury mine is located on Dunn Creek, a tributary to Marsh Creek in the upper watershed. This abandoned mine is a potential source of mercury to the Dutch Slough project area, but regional monitoring studies indicate that MeHg levels in the project area are among the lowest in the Bay-Delta region.

Runoff from the historic mercury mine tailings in the upper reaches of Marsh Creek has resulted in high concentrations of MeHg in the upper watershed (Slotton, 1998), but the Marsh Creek reservoir upstream of Brentwood appears to trap a significant amount of sediment, and presumably mercury, from the mine tailings site. It is unclear how much inorganic mercury is transported to lower Marsh Creek and Big Break, but several years of fish tissue sampling suggest that MeHg levels in Big Break are lower than other locations in the Delta and substantially lower than MeHg levels in San Francisco Bay as well as the northern and southern Delta. However, because rates of mercury methylation do not directly correspond to the concentrations of inorganic mercury, the amount of inorganic mercury transported to Marsh Creek and Big Break cannot be determined by the level of MEHg in fish. Inorganic mercury must be methylated before it can bioaccumulate in fish. Soil samples from Ironhouse lands on the western side of Marsh Creek indicate that inorganic mercury levels at that site are within natural ranges and do not reflect any anthropogenic influence despite decades of irrigation with Marsh Creek water.

Historic mercury mining in the upper watershed has resulted in elevated concentrations of mercury in the upper creek as mine tailings containing mercury continue to erode overtime and transport into the creek. Marsh Creek Dam and reservoir, located below the historic mining areas and many miles upstream of the Dutch Slough site, capture mercury-laden sediments from the historic mines. U.C. Davis researchers, Slotten and others (1998) found that mercury concentrations in stream invertebrates and resident fish were significantly higher close to the historic mine sites, and gradually decreased moving downstream closer to the Marsh Creek Reservoir. An earlier study by Slotton et al. (1996) measured total and dissolved mercury and total suspended solids (TSS) in various locations throughout Marsh Creek.[1] Results from this sampling event showed that total mercury concentrations were similar above Marsh Creek Reservoir to lower Marsh Creek at Delta Road in Oakley, ranging upstream to downstream from 37.67 to 43.7 nanograms per liter (ng/L) (approximately 0.04 parts per billion [ppb]). Dissolved mercury concentrations were also relatively consistent above and below the reservoir, measuring from 6.44 to 8.8 ng/L (app. 0.01 ppb). TSS measurements were found to increase from upstream to downstream while the amount of mercury adsorbed to solids decreased upstream to downstream from 1.25 ppm to 0.58 ppm.

[1] The sampling event for this study took place following a significant storm event in 1995, and was designed to study rain-induced mobilization of mercury from the Diablo Mercury Mine. Therefore, results from this study are representative of a single higher discharge event during a relatively wet year.

Loads of total and dissolved mercury and TSS were estimated using the data from Slotton et al. (1996) and, like the concentrations, total and dissolved mercury loads did not show significant variability above the reservoir to the downstream sampling location. Total mercury loads ranged from 10.23 grams per day (g/d) to 10.27 g/d while dissolved mercury loads ranged from 2.39g/d to 1.75 g/d upstream to downstream. Similar to TSS concentrations, TSS loads increased substantially from upstream to downstream ranging from 6,273 kilograms per day (kg/d) to 14,610 kg/d. But in contrast to TSS mercury concentrations, TSS mercury loads increased from 7.84 g/d above the reservoir to 8.47 g/d at the downstream sampling location.

Bioavailable MeHg levels are also elevated in the upper watershed but appear to decline in the downstream direction. According to UC Davis researchers (Slotton et al., 1998), stream invertebrates and resident fish living directly downstream of the abandoned mine sites had significantly higher levels of MeHg in their tissues than invertebrates and fish upstream of the abandoned mine sites. Whole body MeHg concentrations in native stream fish such as California roach, hitch and three-spined stickleback, showed a 5- to 6-fold increase in specimens below the confluence with Dunn Creek as compared to specimens upstream of the confluence. Slotton et al. (1998) also found that 85% of fish sampled between the Dunn Creek inflow and the Marsh Creek Reservoir contained mercury concentrations above the California Department of Health consumption guideline levels. In addition, the research showed that mercury levels in fish and stream macro-invertebrates declined along a gradient moving downstream from Dunn Creek to the Marsh Creek Reservoir. Although mercury concentrations in the sampled biota declined along the downstream gradient, mercury laden sediments originating from the abandoned mine sites are accumulating behind the Marsh Creek Dam. Shallow wetland conditions in the reservoir provide an environment conducive for methylating the inorganic mercury, resulting in the contamination of the Reservoir's fishery (Slotton et al., 1998).

METHYLMERCURY IN DUTCH SLOUGH RESTORATION ZONE

Despite high levels of inorganic mercury and MeHg in the upper watershed, MeHg levels in Big Break, at the terminus of Marsh Creek, have consistently been a low spot in the entire Bay-Delta for silverside and clam mercury bioaccumulation over several years of fish sampling (Slotton *et al.* 2006). Silverside mercury was sampled in this area at the Big Break Index (33±3 ng/g) and at the base of Marsh Creek near the confluence with Big Break (28±2 ng/g) in 2006. Consistent with historic sampling, these areas had among the lowest silverside mercury in the entire study area. The fish from the base of Marsh Creek had the lowest mercury levels. The highest silverside mercury concentrations in the study area were found in the Yolo Bypass (169±10 ng/g) and Cosumnes River near the floodplain (180±24 ng/g). Other concentrations in the study area included: Montezuma Slough, east end (53±4 ng/g), Sherman Island (53+2 ng/g), and Montezuma Slough, west end (33+2 ng/g).

A third Dutch Slough-related site was Emerson Slough, which cuts deep into the proposed restoration area. At present, the habitat of this site is clear water, deep, rock-lined canal with submerged aquatic vegetation. Silversides were not present, but Slotton's team was able to take good samples of juvenile largemouth bass and bluegill for analysis. Samples were analyzed from all three of the sites and normalized for weight. Mercury concentrations in bass were lowest at the Marsh Creek site (55 ng/g), intermediate at the Big Break Index (66 ng/g), and somewhat higher in Emerson Slough (77 ng/g). The highest Largemouth Bass mercury concentrations in the study area were found in the Cosumnes River (232 ng/g). Other concentrations in the study area included: Dead Horse Cut (79 ng/g), Franks Tract (46 ng/g), and Prospect Slough (35 ng/g).

ENDOCRINE DISRUPTING CHEMICALS (EDCS)

Endocrine disrupting chemicals (EDCs), such as pesticides, pharmaceuticals and personal care products (PPCPs), are known to be components of incompletely treated wastewater. Concern about these contaminants has been developing in recent years. EDCs are compounds that can stop production or alter transmission of hormones in organisms and can be derived from natural and artificial sources. Examples of known effects in fish and amphibians resulting from continuous exposure to low-level concentrations include thyroid malfunction, sex alteration, reproductive failure, and growth reduction (NSTC 1996). Research on the fate of certain EDCs (nonylphenol) in effluent irrigated soils (Harms 1986) indicated that there is potential for uptake of EDCs in plants irrigated with sewage effluent. PPCPs are derived from pharmaceutical drugs, cosmetics, and food supplements, and while their impacts on organisms are not clearly understood, they are intended to have biological effects on humans and are assumed to have unintentional effects on organisms in the environment (Ying et al. 2004). PPCPs may be present in wastewater discharges and are not likely to be found in urban or agricultural runoff. The Central Valley Regional Water Quality Control Board (CVRWQCB) and USEPA have not established water quality objectives for most EDCs for protection of aquatic life (See *Regulatory Setting* section). Neither the BWWTP nor Ironhouse Sanitary District wastewater have been specifically tested for presence of endocrine disrupting chemicals (EDCs) or pharmaceuticals and personal care products (PPCPs).

AGRICULTURAL AND URBAN RUNOFF

Both agricultural and urban runoff have various well-known negative impacts to water quality. Years of agriculture, cattle grazing and dairy operations can result in lower concentrations of dissolved oxygen from increased concentrations of nitrogen and increased toxic pollutants from fertilizers, pesticides and herbicides that introduce synthetic toxins. Slotton et al. (1998) found that water quality from 1995 to 1997 was so degraded in the lower watershed that aquatic insects were essentially absent, and attributed these conditions to urban and agricultural discharges.

VEGETATION REMOVAL

Removal of riparian vegetation and elimination of adjacent floodplain areas has also resulted in impacts to water quality in Marsh Creek. The historic riparian corridor of Marsh Creek has been narrowed, eliminated, or degraded as adjacent floodplains have been converted for agriculture or development and as flood protection levees have been built to prevent flood damage. As a consequence, the filter effect of vegetation on sediment and pollutants draining across the landscape and settling on the floodplain has been reduced. Loss of riparian vegetation can also decrease pH (increase acidity), which increases solubility of chemical constituents making them biologically available to aquatic organisms. Shade also has been reduced resulting in elevated water temperatures and reduced dissolved oxygen.

Description of Water Quality by Project Sub-Area

EMERSON, GILBERT, AND BURROUGHS PROPERTIES

The Emerson, Gilbert, and Burroughs properties are former tidal marsh with relic dunes, historically surrounded by seasonal and riparian wetlands and the Marsh Creek delta. The site was diked and drained for agriculture as early as the 1850s (NHI 2004). All three parcels were originally used for dairy operations. The Gilbert and Burroughs parcels were converted to grazing in the mid-1970s, and the Emerson parcel remained a dairy until 2003. In 1990 and 1991, the Emerson parcel imported 500 acre-feet per year of secondary treated wastewater from the nearby Oakley-Bethel Island Wastewater Treatment Plant (now Ironhouse Sanitary District), for "leaching of peat soils" (James Montgomery 1991; see "Ironhouse parcel" section below for discussion of water quality). It is uncertain for how many years this irrigation took place, or at what time it was ceased. Since 2003, all three parcels have been used as irrigated pasture for cattle grazing, with some gas production from onsite wells. Phase 1 Environmental Site Assessments (Engeo 2003a, 2003b, Sequoia 2003) were carried out to identify land use and site conditions that have resulted or could result in soil, surface water, or groundwater contamination. These studies found conditions including stored chemicals; an above-ground fuel storage tank; previous existence of electrical transformers containing polychlorinated biphenyls (PCBs); fuel; solid waste and debris; livestock manure piles and dairy runoff; and active and inactive natural gas and groundwater supply wells. More information on these is included in Section 3.15, Hazardous Materials.

All known hazardous materials and conditions were removed or otherwise remediated under the supervision of the Department of Water Resources. Soils containing petroleum hydrocarbons, mercury, barium, or PCBs were removed or remediated to levels below USEPA residential and aquatic toxicity criteria (Tom Hall, DWR internal memo August 25, 2003). Groundwater concentrations of nitrogen (including total, nitrate, nitrite, and total Kjeldhal) were elevated, as would be expected from the dairy and manure contributions, but nitrate and nitrite concentrations after remediation were reportedly below drinking water criteria (i.e., USEPA Primary Maximum Contamination Levels (MCLs): nitrate = 10,000 parts per billion (ppb), nitrite = 1,000 ppb; DWR 2003). Residual concentrations of petroleum in groundwater were found to be above the water quality objectives for drinking water (i.e., 21 ppb for toxicity and 5 ppb for tastes and odors, per CVRWQCB memo 4/1/2004), however it was concluded that these levels would decrease naturally over time due to biodegradation and adsorption to organic material, and so no additional actions were taken (DWR 2003).

Natural gas wells exist on all three properties, and mineral rights have been reserved for continued operation of one gas well on each property. All inactive wells are to be abandoned and plugged by summer of 2008 as directed by the agreement of sale. Several groundwater wells exist on the properties, and one or more may continue to be used by the City Park. All unused wells are to be abandoned in accordance with County requirements.

Groundwater elevations vary, likely due to differences in local groundwater withdrawals and recharge rates. Groundwater naturally flows in a northerly direction towards the Delta due to local geology, but local groundwater pumping significantly alters flow direction at some times of the year. Groundwater elevations at the Project site are estimated to be between +3 and -10 feet with respect to mean sea level (PWA, 2006). The diked, tidally isolated nature of the site has resulted in lowering of groundwater from evapotranspiration and pumping to maintain dry lands. Dutch, Little Dutch, and Emerson sloughs contribute to recharge of the groundwater aquifer below the Project site.

All three parcels are substantially subsided, particularly in the northern portions nearest Dutch Slough, with a total of up to 750 acres lying below the elevation of Mean Lower Low Water (-0.29 ft NGVD; PWA 2006). Under current operation, the parcels may be irrigated with water from the Emerson and Dutch Sloughs during the dry summer months. However, during wet months, accumulated surface water is pumped off of the site into the adjacent sloughs. Although no data is available on the quality of the pumped water, based on past and current land uses, it can be assumed that it contains elevated concentrations of nutrients, organic carbon, and coliform bacteria.

MARSH CREEK

Marsh Creek borders the Emerson property on the west, and is proposed as an integral component of the Ironhouse Restoration and the Marsh Creek delta restoration options on the Emerson parcel. The quality and amount of water in Marsh Creek is strongly influenced by historic and present land uses in the watershed, including historic mercury mining in the upper watershed, discharges from the Brentwood Waste Water Treatment Plant (BWWTP) upstream from the Project site, agriculture, and urbanization.

The ISD collected monthly water quality data in lower Marsh Creek (referred to as the Oakley Ranch Supply) from 1986 to 1994. Average concentrations of Total Dissolved Solids (TDS), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), chloride (Cl), sulfate (SO4), and alkalinity are summarized in **Table 3.2-1**.

Table 3.2-1. Marsh Creek Oakley Ranch Supply Average Concentrations (mg/L) (1986-1994)

TDS	*Ca*	*Mg*	*Na*	*K*	*Cl*	*SO4*	*Alkalinity*
785	55	27	184	8	197	140	260

The BWWTP, 3.5 miles upstream of the Project site, treats 4.5 million gallons per day (mgd) of municipal wastewater from the City of Brentwood and discharges a portion of that (0.25 mgd during low flows and 0.60 mgd during high flows) into Marsh Creek[2]. These discharges are regulated under the National Pollution Discharge Elimination System (NPDES) permit program administered by the Central Valley Regional Water Quality Control Board. A summary of water quality monitoring data from the BWWTP NPDES monitoring program for years 2000 to 2004 are shown in **Table 3.2-2**, and loads calculated for the same period are summarized in **Table 3.2-3**. Brown and Caldwell (2006) estimated that on average, 18% of wet weather and 61% of dry weather flows in Marsh Creek were treated wastewater discharged from the BWWTP.

Table 3.2-2. Brentwood Wastewater Treatment Plant Discharge Concentrations (2000-2004)

2000-2004	*Flow (MGD)*	*BOD (mg/L)*	*NH3 (mg/L)*	*NO3 (mg/L)*	*P (mg/L)*	*TDS (mg/L)*	*Total Coliform (MPN/100mL)*
Minimum	0.5	1.0	0.05	0.22	0.69	820	2
Maximum	3.0	12	1.90	13	3.40	1,400	1,600
Average	2.1	3.0	0.38	3.04	1.97	1,231	128

BOD = biological oxygen demand; NH3 = ammonia; NO3 = nitrate

Table 3.2-3. Brentwood Wastewater Treatment Plant Discharge Loads (2000-2004)

2000-2004	*BOD (kg/d)*	*NH3 (g/d)*	*NO3 (kg/d)*	*P (kg/d)*	*TDS (kg/d)*
Minimum	82,625	189	70,240	136,569	70,240
Maximum	490,374	5,429	429,374	401,019	429,374
Average	348,276	2,199	305,295	297,430	294,100

[2] The treatment system consists of screening, grit removal, oxidation and nitrification (by extended aeration activated sludge), denitrification (by anoxic basins), coagulation, tertiary treatment filtration, chlorination and dechlorination. The new treatment plant went online in March 2003.

It should be noted that the BWWTP upgraded to a tertiary treatment system in mid-2003, and the above averaged monitoring data may not be representative of current water quality.

IRONHOUSE PARCEL

The 100-acre Ironhouse Project site is used by ISD for disposal (through irrigation) of treated wastewater from the communities of Oakley and Bethel Island. Prior to application to the site, the wastewater is treated in two-stage aerated treatment ponds (secondary treatment), and disinfected with sodium hypochlorite. The northern portion of the Ironhouse parcel, from approximately 500 feet north of the CCWD Canal north, has received reclaimed wastewater applications since 1982. The wastewater application was not uniform and some fields received more than others. Prior to that year, it was irrigated with water pumped from Marsh Creek. The southern portion of the property, from approximately 500 feet north of the CCWD Canal south (including south of the Contra Costa Canal), began receiving reclaimed wastewater in 1992 (HydroFocus 2003).

Water quality in the project site could be impacted by chemical condition of soils from the Ironhouse parcel which are to be used as fill on the Emerson, Gilbert and Burroughs properties under Alternatives 2 and 3. Soils from the Ironhouse parcel were analyzed by Stellar Environmental Solutions, Inc. (SES), at the request of Natural Heritage Institute, in August 2006. Samples were taken from above two feet above mean sea level to obtain information about the soil that is proposed for use as project fill. The locations for sampling included areas known by the ISD to have received proportionately more, or less, wastewater. As results were relatively similar (despite the different lithologies of the samples), it was concluded by SES that the samples were representative of the site in general and no more sampling was necessary. However soil samples from the wettest bore showed highest concentrations of the detected analytes. The water in these samples probably most closely represents groundwater rather than treated wastewater recently irrigated on the ground surface.

Samples were analyzed for California Title 22 (CAM 17) Metals (total metal concentrations only); semi-volatile organic compounds (SVOCs) and polynuclear aromatic hydrocarbons (PAHs) (full list) by EPA Method 8270; chlorinated herbicides by EPA method 8151; ammonia (as nitrogen) by EPA Method 350.3 and chloride by EPA Method 300.1; total petroleum hydrocarbons (motor oil range) by EPA Method 8015 (replaces test for "oil and grease").

No SVOCs, PAHs or herbicides were detected above the reporting limits (Table 3.2-4). Diesel and motor oil grade hydrocarbons were detected in several samples at concentrations between 1.2 and 88 mg/kg and were at higher concentrations in the shallower soil samples. The lighter, motor oil fraction was generally present at around twice the diesel concentration. SES concluded that the hydrocarbons most likely had some airborne source. None of the metals were detected at concentrations above guideline levels set by the San Francisco RWQCB for determining the general suitability for dredged material for beneficial reuse (wetland restoration) projects (SFRWQCB 2000). The range of metal concentrations in these soil samples is included in Table 3.2-4 (see also section on sediment screening criteria below). The SFRWQCB guidelines were used in this study because no such standards exist for wetland restoration in the Central Valley Region. It is anticipated that the CVRWQCB will default to the SFRWQCB standards for wetland restoration projects with potential modifications on a case-by-case basis.

Ammonia (as nitrogen) was detected in only one of 15 samples at 5.6 mg/kg, which is considered low. Chloride was detected at a range of 15-370 mg/kg. (There are no wetlands criteria for either ammonia or chloride).

Table 3.2-4. Concentrations of CA Title 22 (CAM 17) Metals in soil samples from Ironhouse Parcel and comparison to SFRWQCB 2000 screening criteria

Constituent	Range in Samples (mg/kg)	SFRWQCB 2000 Wetland Reuse Screening Criteria (mg/kg)	
		Wetland Surface Material	Wetland Foundation Material
Arsenic (As)	1.1 – 8.6	15.3	70
Chromium (Cr)	10 – 50	112	370
Lead (Pb)	1.5 – 8.9	43.2	218
Mercury (Hg)	0.021 – 0.099	0.43	0.7
Selenium (Se)	0.42 (1 sample)	0.64	NA

The Ironhouse Project site soil was not analyzed for coliform bacteria nor for EDCs (see discussion above). The treatment plant effluent that was irrigated on the Ironhouse parcel was analyzed directly in 1991 as part of a study for a potential constructed wastewater treatment wetland (James Montgomery 1991). The analysis showed non-detectable levels (at method detection limits) of priority pollutant pesticides, all PCBs, all regulated volatile organic carbons (VOCs), dioxin, phenol, hazardous substance compounds, most metals (including hexavalent chromium, arsenic, cadmium, mercury, selenium, silver, nickel, and lead), and most extractable priority pollutants. Copper and zinc were present at 0.019 and 0.073 mg/L, respectively, and bis (2-ethylhexyl) phthalate was present at 40 μg/L. A summary table of effluent data in the 1991 report indicated concentrations of metals may have been at the following levels: arsenic-5 μg/L, mercury-2 μg/L, cadmium-5 μg/L, chromium-10 μg/L, copper-20 μg/L, nickel-35 μg/L, lead-10 μg/L, zinc-73 μg/L, 10 μg/L, and selenium-5 μg/L (James Montgomery 1991, Figure 3-2), but these levels are below the method detection limits indicated on the laboratory reports.

The ISD has performed groundwater monitoring on the shallow aquifer beneath their irrigated pasture lands over the years for compliance with CVRWQCB requirements. Table 3.2.5 provides a summary of data collected between 2000 and 2005 from selected groundwater wells3. A 2003 study, designed to evaluate the impact of the wastewater irrigation on the beneficial uses of groundwater (HydroFocus 2003) attempted to develop indicators for determining the presence of wastewater in groundwater at the site (Table 3.2.5). The study concluded that TDS and chloride concentrations were consistent with estimated pre-existing conditions, and did not indicate a wastewater presence. Of the many parameters tested (not all of which are listed in Table 3.2-5), the study found that fluoride provided the best indicator of the presence of wastewater in groundwater.

[3] Most monitoring wells on the Ironhouse Sanitary District lands are placed in areas remote from the property being discussed herein, or are placed at interfaces between the property and other groundwater influences (e.g., Dutch Slough or Contra Costa Canal). The results shown in Table 3.2-5 are for a limited number of wells selected for the purposes of this report (mainland wells 15, 17, 18, 21, 26) as most representative of potential groundwater concentrations on the Ironhouse parcel itself.

BIG BREAK

Water quality at Big Break can be expected to be similar to Dutch Slough and the rest of the Sacramento-San Joaquin Delta (see discussions for each, below). The US Bureau of Reclamation and

Table 3.2-5. Groundwater Data for Selected Groundwater Wells on or Near the Ironhouse Parcel (Ironhouse 2005, HydroFocus 2003)

Parameter or Constituent	*Range of measurements at five representative wells*	
	Compiled 2000-2005 Data (Ironhouse 2005)	*2003 Study (HydroFocus 2003)*
pH	7.0-8.0	7.0-7.4
Electrical conductivity		1620-4190 µS/cm
Dissolved oxygen		0.0
Chloride (Cl)	80-660 mg/L	200-700 mg/L
Sulfate (SO4)	25-2300 mg/L	130-1400 mg/L
Hardness (HCO3)	310-880 mg/L	362-647 mg/L
Calcium (Ca)	61-520 mg/L	53-160 mg/L
Chromium (Cr)	0.003-0.07 mg/L	-not analyzed-
Copper (Cu)	0.003-0.4 mg/L	-not analyzed-
Lead (Pb)	0.002-0.02 mg/L	-not analyzed-
Magnesium (Mg)	41-300 mg/L	54-310 mg/L
Sodium (Na)	170-580 mg/L	230-650 mg/L
Total dissolved solids (TDS)	740-4000 mg/L	930-5300 mg/L
Bromide (Br)	0.5-8 mg/L	0.47-6 mg/L
Fluoride (F)	0.2-1 mg/L	0.4-0.5 mg/L
Phosphate as P (PO4-P)		0.1-0.82 mg/L
Nitrate (NO3)		14 mg/L
Nitrite (NO2)		0.4 mg/L
Total Kjeldhal Nitrogen (TKN)		0.1-0.3 mg/L
Total Coliform	8-1600 MPN/100ml	<2->1600 MPN/100ml
Total trihalomethanes (THMs)		<0.50 µg/L detection limit

Table 3.2-6 Big Break Water Quality (1980-1995)

Constituent/Parameter	*Unit*	*maximum*	*minimum*	*average*	*median*
pH		8.9	6.6	7.8	7.8
Temp	ºC	25	8	18.5	20
Dissolved Oxygen	mg/L	12.2	6.8	9.1	9.1
Dissolved Chloride	mg/L	994	8	185	73
Conductivity	µS/cm	4,920	115	851	506
Total Dissolved Solids	mg/L	2,100	75	439	233
Total Suspended Solids	mg/L	206	3	19.5	14
Nitrate + Nitrite	mg/L	1.2	0.01	0.33	0.31
Dissolved Ammonia - N	mg/L	0.8	0.01	0.05	0.03
Source: Bay Delta and Tributaries (BDAT) Project, http://baydelta.ca.gov. USBR-DWR Station D14.					

Department of Water Resources collected monthly water quality monitoring samples within Big Break (Station D14A) between 1968 and 1995. Selected water quality data from this station is summarized in Table 3.2-6. Total mercury concentrations in Big Break were measured twice annually from 1988-1993. During each sampling event, total mercury concentrations were 1 microgram per liter (ug/L) (BDAT).

The San Francisco Estuary Institute's Regional Monitoring Program collects and compiles water quality monitoring data on pollutants of concern for 31 monitoring stations within the Bay Estuary. The eastern-most station is located 4.3 miles west of Big Break, on the San Joaquin River. Flows at this location are dominated by the San Joaquin River, with some influence from the Sacramento River, but the water quality conditions can be expected to be similar to Big Break, and are instructive for the purposes of analysis. Summary data on selected constituents are provided in Table 3.2-7.

Table 3.2-7. San Joaquin Water Quality Data 4.3 Miles West of Big Break (1993-2003)

Constituent/Parameter	*Unit*	*maximum*	*minimum*	*average*	*median*
pH		8.10	6.30	7.59	7.70
Temp	ºC	23.7	9.5	17.2	17.4
Dissolved Oxygen	mg/L	11.24	7.35	8.87	8.68
Dissolved Organic Carbon	µg/L	6,528	1,606	2,951	2,329
Conductivity	µS/cm	3,610	110	665	223
Total Suspended Solids	mg/L	70	11	28	25
Nitrate	mg/L	0.74	0.17	0.36	0.28
Ammonia - N	mg/L	0.21	0.00	0.07	0.04
Dissolved Polyaromatic Hydrocarbons (PAHs)	pg/L	9,385	341	5,180	2,035
Total PAHs	pg/L	23,085	2,822	7,983	6,668
Dissolved Polychlorinated biphenyls (PCBs)	pg/L	289.10	15.90	95.55	90.20
Total PCBs	pg/L	704.40	66.10	195.12	162.91
Total Chlordanes	pg/L	253.50	25.76	125.67	113.90
Total DDTs	pg/L	1,049	175	429	365

Source: Regional Monitoring Program Status & Trends Monitoring Data. RMP Station BG-30 (longitude -21.806, lat 38.02). Approximately 20-25 samples collected 1993 - 2003 http://www.sfei.org/rmp/rmp_data_access.html.

EMERSON AND LITTLE DUTCH SLOUGHS

Emerson and Little Dutch Sloughs are artificial dead-end sloughs that divide the Dutch Slough Restoration Project site and would serve as the primary tidal water source for the Dutch Slough Restoration Project. Currently no water quality data are available for either slough; therefore Big Break water quality (above) is considered to be the best representation. Limited salinity data were collected from Little Dutch Slough for comparison to salinity in nearby irrigation ditches. Results indicated that salinity levels were similar, with a median conductance of 1,148 microsiemens per centimeter (μs/cm), which is generally in the range of drinking water (50-1,500 μs/cm; Balance Hydrologics, 2005)[4.]

DUTCH SLOUGH

The hydrology of Dutch Slough was described in Section 3.1. Water quality in the slough is influenced by Delta and Marsh Creek flows, and by surrounding land uses. Historical and current discharges of drainage from agricultural lands adjacent to Dutch Slough (including the Emerson, Gilbert, Burroughs, and Ironhouse Properties) contribute to degrading water quality in the slough by inputting excess nutrients, fertilizers, pesticides and emerging contaminants (see discussion of water quality in the Sacramento-San Joaquin Delta, below). Salinity levels in Dutch Slough fluctuate according to season and type of water year (wet, normal, dry). Salinity levels are discussed further in Section 3.1, Hydrology. The United States Bureau of Reclamation measured daily salinities in Dutch Slough using electric conductivity measurements from January 1, 1964 to December 31, 1998. Figure 3.2-1 summarizes those data as salinity concentrations (in parts per thousand, ppt) by type of water year. As shown in the figure, salinities in Dutch Slough did not rise above 1 ppt, even during years with historically low Delta outflow. There are currently no other water quality data available for Dutch Slough, but the data from Big Break are considered an appropriate surrogate.

SACRAMENTO-SAN JOAQUIN DELTA

The configuration and hydrology of the Sacramento-San Joaquin Delta was described in Section 3.1. The three closest water supply intakes (or "pump stations") are depicted in Figure 3.2-2. The Rock Slough and Old River intakes are 10 and 15 water-miles upstream, respectively, from the Dutch Slough site. Due to the presence of a permanent barrier in Sand Mound Slough (see Figure 3.2-2), water in Dutch Slough must travel upstream and around Holland Tract to reach the diversion points at Rock Slough and Old River. The two intakes collect water for the Contra Costa Canal (discussed further below), which provides water to approximately 500,000 users in Contra Costa County.

The Harvey O. Banks intake (20 water-miles upstream) is the northern most intake of the 444-mile California Aqueduct, the main artery of the State Water Project. Rock Slough and Old River intakes pump 0.1 million acre feet (maf) per year to the Contra Costa Canal, primarily in the winter months. The Harvey O. Banks intake pumps 5-7 maf per year to the State Water Project.

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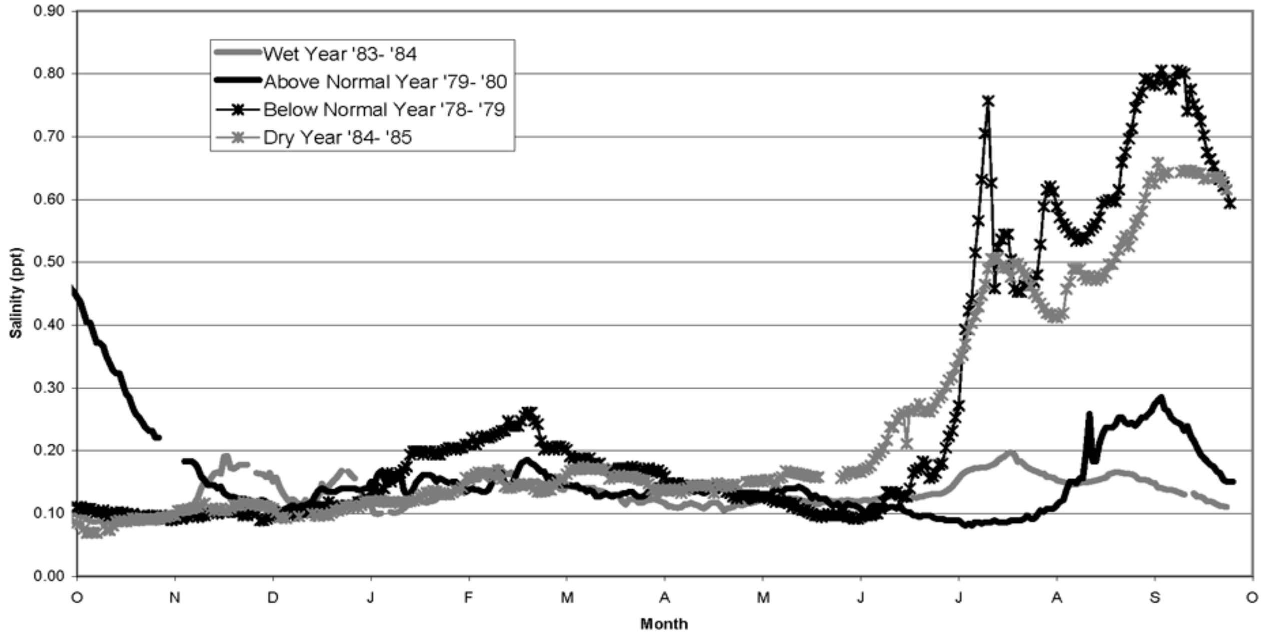
[4] Specific conductance is a widely used index of salinity. Conductance is a measure of the ability of water to transmit an electrical current, and it is proportional to the amount of dissolved solids in the water. Dissolved solids are, in turn, directly correlated to salinity; thus, the greater the conductance, the greater the salinity. Specific conductance is conductance standardized to 25º Celsius. When specific conductance was first defined in 1964, it was defined as "the reciprocal of the resistance in ohms", and the unit for reporting was defined as "micromhos per centimeter" ("mho" being the "reciprocal" of "ohm"). In recent years, the SI unit "microsiemens per centimeter" (μS/cm) has come into common use, and the two terms are interchangeable. In print, if the Greek symbol "μ" (mu) is not available, a small letter "u" is usually substituted, so the unit will be reported as uS/cm or umhos/cm.

The relationship of conductance to the concentration of salt ions in a water sample is specific to each water source. Typically, specific conductance in freshwater ranges from 0 to 1,300 μS/cm, brackish water ranges from 1,301 to 28,800 μS/cm, and salty water is greater than 28,800 μS/cm. Specific conductance has also been used to distinguish water of different origins. For instance, specific conductance of 30 to 50 μS/cm might indicate fresh rainwater, while 53,000 μS/cm would suggest a hypersaline lake. Groundwater typically has higher specific conductance than surface water because the water has moved through the soil column and acquired a higher concentration of dissolved solids or "salts." However, distinguishing between groundwater and brackish or saline surface water based on conductivity can be difficult without additional information.

Figure 3.2-1. Salinity Measurements in Dutch Slough (1978-1985)



Source: USBR, Central Valley Operations Office, in PWA 2996.

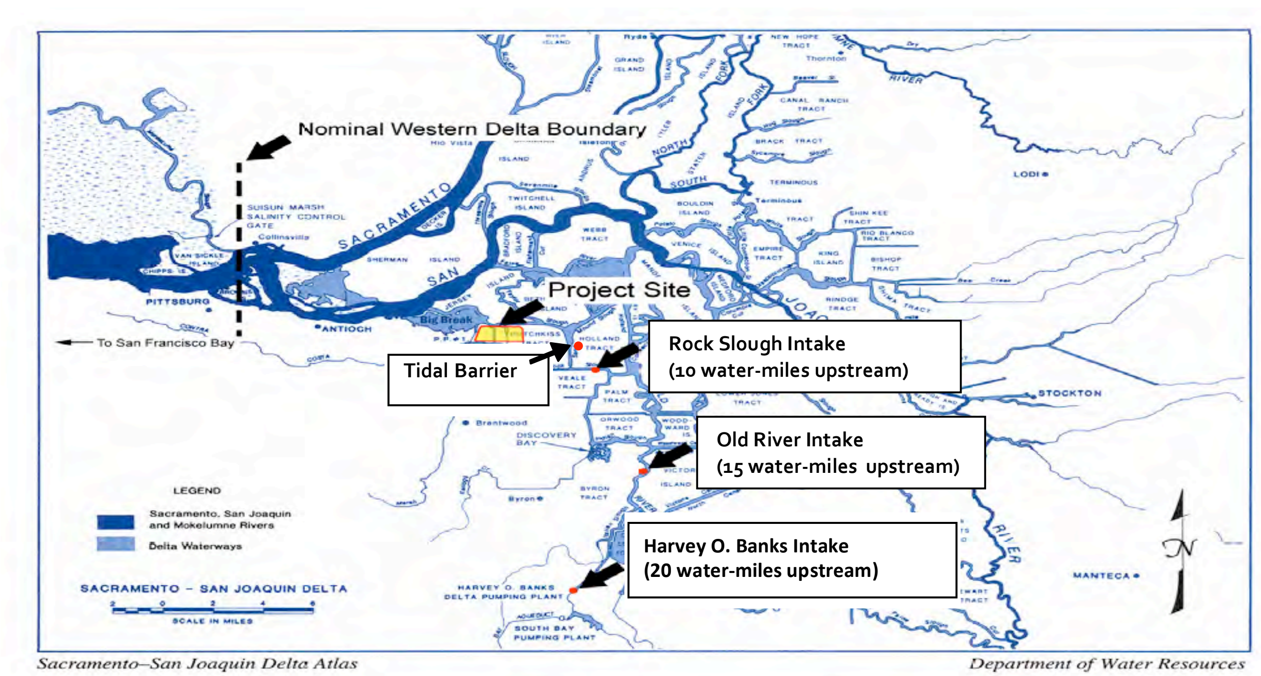


Figure 3.2-2. Location of Three Drinking Water Supply Intakes in the Vicinity of the Project.

WATER QUALITY IN THE DELTA

Water quality in the Delta is complex. Inflow from the Central Valley carries with it elevated concentrations of nutrients, salts, pesticides, and other agricultural byproducts, mercury and other metals, and other pollutants. Inflows also provide large volumes of organic carbon – the critical foundation for the aquatic food chain (Jassby 1992, Brown 2003, and others), but a serious water quality problem for water supply systems (Brown 2003, USEPA 2006). Some forms of organic carbon, particularly dissolved organic carbon (DOC), can combine with bromide during water purification and form carcinogenic trihalomethanes (THM). Tidal inflows can elevate salinity (including bromide), particularly during dry years (this effect was reduced by the construction and management of dams in the upper watersheds in the 1940s for salinity control) (USGS 2000). Organic carbon can be produced within a water system by phytoplankton, benthic microalgae, microalgae, seagrasses, or photosynthetic bacteria, or imported from river flows, stormwater runoff, atmospheric deposition, oil spills, or other external sources (Jassby 1992, Jassby et al. 1993). Total organic carbon import and export from the Delta was modeled by USEPA (USEPA 2006). During a typical wet year, total organic carbon (TOC) imports to the Delta from watershed sources were estimated at 155,000 tons. Within the Delta, dewatering from Delta islands and other agricultural sources contributed 24,000 tons, and tidal marsh export and primary ecological production together contributed 12,000 tons. Most of the TOC was estimated to be exported to the Bay, with approximately 28,000 tons being taken in by the water supply systems (Figure 3.2-3). During dry years, TOC contribution from the watershed was reduced to 54,200 tons, while contributions from within the Delta were estimated to remain the same.

Within the Delta, drainage water from Delta islands with peat soils is estimated to contribute from 20% to 50% of the dissolved organic carbon that leads to formation of THMs in water exported by the State Water Project (Amy et al. 1990). The western Delta is listed on the 2003 Clean Water Act Section 303(d) List of Impaired Waterways as impaired for chlorpyrifos, DDT, Diazinon, electrical conductivity, “group A” pesticides, mercury, and “unknown toxicity”. In addition, Old River is listed as impaired for dissolved oxygen. (USEPA 2003)

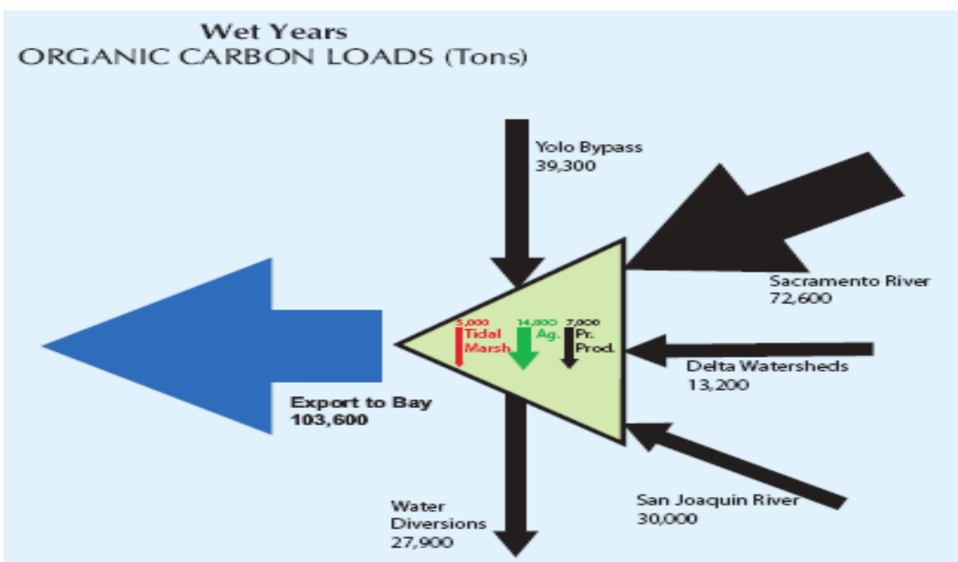


Figure 3.2-3. Total Organic Carbon Load to the Sacramento-San Joaquin Delta during a Typical Wet Year (USEPA 2006)

Because of the complexity of the Delta hydrology and water quality issues and its importance as a primary water supply for much of California, the State Department of Water Resources, State Water Resources Control Board, US Environmental Protection Agency, U.S. Geological Survey, and others, independently and through collaboration with the Calfed Bay-Delta Program, have undertaken extensive efforts to reduce uncertainty and develop a long term approach to restore the ecological health and improve water management of the system. Restoration of tidal wetlands in the Delta is seen as an important component of the effort (Brown 2003).

CONTRA COSTA CANAL

The Contra Costa Canal (Canal) is a 48-mile long artificial water supply canal servicing the Diablo Water District and Contra Costa Water District. The Canal is primarily concrete lined except for the first 3.97 miles and was originally constructed as part of the Central Valley Project between 1937 and 1940 to provide Delta water to the surrounding area. The Canal begins at Rock Slough (see Figure 3.2-2), which is connected to the Delta and located just to the east of the Project site. Rock Slough feeds Delta water to the Canal before it flows west forming the southern boundary of the Project. Most of the area surrounding the Canal is farmland and open space with significant conversion to residential development planned or underway. The Cypress Grove development (under construction) is located within the Eastern Cypress Corridor on the southern side of the Canal immediately across from the Dutch Slough Restoration Project and the planned City Community Park. The Canal is crossed by several roads and sloughs but has no direct hydrologic connection to other waterways. Contra Costa Water District has proposed the Contra Costa Canal Encasement Project to bury 3.97 miles of the Canal in a pipeline, including the reach between the Project and the Eastern Cypress Corridor. The primary purpose of the Encasement Project is to protect water quality in the earth lined portion of the Canal that can be degraded from interaction with local groundwater.

Water quality in the Contra Costa Canal is governed by the quality of water at its intake at Rock Slough, which varies depending on the volume of flows from the San Joaquin watershed, the amount of pumping at the Rock Slough and Old River intakes, the relative salinity import into the Delta from the Bay, and other factors (see the discussion of water quality in the Sacramento-San Joaquin Delta, above). Of particular concern for water supply purposes are salinity, total organic carbon, and bromide (see Delta discussion, above). Salinity measurements (measured in terms of electrical conductivity) at the Rock Slough intake for April 2003-April 2004 ranged from a low of 160-170 □S/cm during June and July 2003, to a high of 712 □S/cm during December 2006 (Figure 3.2-4). These levels are consistent with fresh- water of relatively high quality.

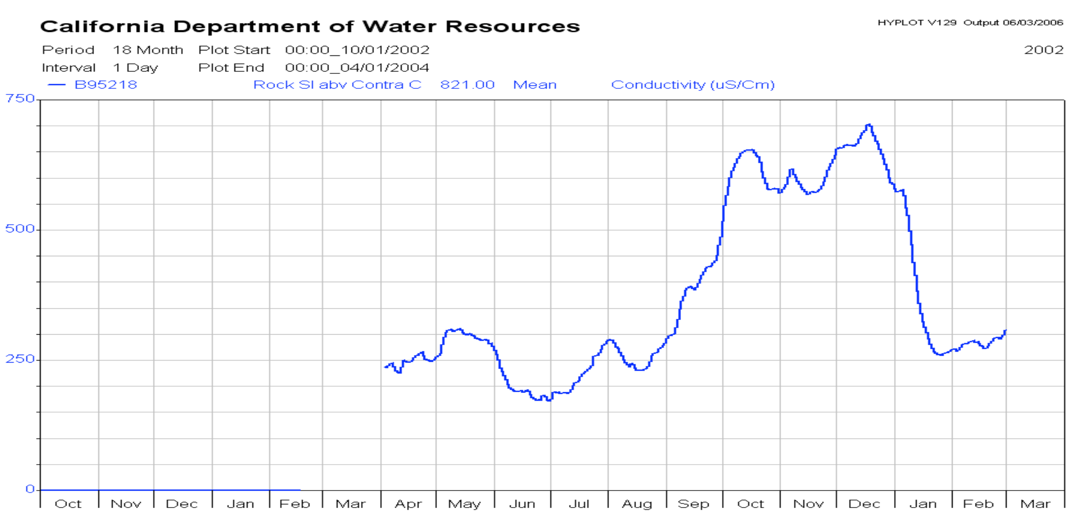


Figure 3.2-4. Plot of Conductivity of Water in Rock Slough at the Contra Costa Canal Water Supply Intake Between April 1, 2003 and April 1, 2004 (Source: DWR Water Data Library, continuous time series data for station B95218).

Dissolved organic carbon (DOC) concentrations measured at the Rock Slough monitoring station at Old River (immediately east of the Contra Costa Canal intake) over a 15 year period are shown in Figure 3.2-5. The Department of Water Resources estimated that between 30% and 50% of the DOC measured at this station was caused by agricultural drainage from Delta peat islands (DWR 2003).

Water and Sediment Quality Monitoring

The Dutch Slough Restoration Project would include a monitoring program to collect additional information for assessing potential water quality impacts and to verify compliance with regulatory requirements. An illustrative approach for the water quality monitoring program is described in Appendix C-2 of the PWA Feasibility Report. It includes establishment of five water quality sampling stations: two in Dutch Slough to the east and west of the project, and one each in Little Dutch Slough, Emerson Slough, and Marsh Creek.

In the suggested program, laboratory analyses for water samples would include some or all of the following: dissolved organic carbon (DOC), total organic carbon (TOC), UV 254, bromide, total mercury, dissolved mercury, MeHg (MeHg), nitrate, ammonia, total kjeldahl nitrogen (TKN), orthophosphate, total phosphorus, zinc, arsenic, copper, cadmium, chromium, lead, nickel, selenium, iron, aluminum, manganese, alkalinity, total dissolved solids (TDS), total coliform, fecal coliform, e. coli, and total suspended sediment (TSS).

Slough bed sediment samples would be analyzed for some or all of the following: MeHg, total mercury, dissolved mercury, total sulfide, iron, manganese, polychlorinated biphenols (PCBs), and organochloride pesticides. Marsh Creek sediment samples would be analyzed for total mercury.

Monthly average DOC with DOC in agriculture drainage (mg/L)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1976	2.19	2.42	2.98	3.17	3.16	3.12	3.18	3.28	3.11	2.80	2.55	2.40
1977	2.42	2.58	2.74	3.05	4.51	4.92	3.74	3.03	3.03	2.82	2.74	2.60
1978	2.58	2.64	3.05	5.66	7.71	6.60	5.01	4.87	3.70	2.94	2.49	2.32
1979	2.35	2.30	2.45	3.63	5.55	5.79	4.07	3.36	2.95	2.56	2.39	2.34
1980	2.27	2.26	2.73	5.62	5.70	5.03	4.39	3.20	3.04	2.72	2.43	2.31
1981	2.37	2.37	2.40	3.03	3.49	3.70	3.73	3.41	2.97	2.54	2.46	2.39
1982	2.28	2.72	5.03	6.46	5.83	5.25	4.59	4.52	3.40	2.65	2.40	2.21
1983	2.57	3.38	4.01	4.83	4.94	5.50	5.19	4.82	3.75	3.71	2.83	2.31
1984	2.67	3.14	3.75	4.38	4.72	3.31	2.77	2.81	2.62	2.50	2.42	2.28
1985	2.23	2.83	3.74	3.91	3.50	3.46	3.45	3.29	2.97	2.55	2.43	2.34
1986	2.28	2.32	3.00	4.74	8.04	6.77	5.37	4.48	3.18	2.95	2.54	2.23
1987	2.27	2.32	2.49	2.91	3.75	5.09	5.76	4.29	3.25	2.70	2.61	2.52
1988	2.45	2.46	2.85	5.07	5.74	5.34	4.20	3.63	3.17	3.06	3.04	2.83
1989	2.69	2.57	2.55	2.83	3.76	4.89	5.68	4.87	3.14	2.52	2.40	2.27
1990	2.17	2.34	2.61	3.55	4.62	4.31	3.92	4.23	3.67	3.44	3.22	2.92
1991	2.62	2.69	2.76	3.50	4.36	4.70	5.80	4.39	3.04	2.98	3.00	2.80
Avg	2.40	2.58	3.07	4.15	4.96	4.86	4.43	3.91	3.19	2.84	2.62	2.44

Figure 3.2-5. Monthly Average Concentrations of Dissolved Organic Carbon at Old River At Rock Slough (1976-1991) Source: DWR 2003.

Field parameters would be collected at all sites and may include GPS coordinates, flow, dissolved oxygen (DO), temperature, pH, conductivity, turbidity. As possible additions, oxidation reduction potential (ORP) and DO may be measured along the vertical profile of the sloughs.

Regulatory Setting

Actions that may affect surface and groundwater quality at the Dutch Slough Restoration Project site are subject to the requirements of the federal Clean Water Act (33 U.S.C. §§ 1251 et seq.; CWA) and associated regulations, the State Porter-Cologne Water Quality Control Act (Cal. Water Code §§ 13000 et seq.) and associated regulations, and to requirements established by the U.S. EPA, State Water Resources Control Board, the Regional Water Quality Control Board, Central Valley Region (CVRWQCB), County of Contra Costa and the City of Oakley.

The CVRWQCB is the lead agency for implementing all State regulations, and it has been designated by U.S. EPA as the State agency responsible for implementing the federal CWA Section 402 (National Pollutant Discharge Elimination System, "NPDES") and Section 401 (certification of Federal permits that might result in discharge to State waters/wetlands). The County of Contra Costa, the Contra Costa Flood Control District, and the City of Oakley are permittees under a regional NPDES permit to implement a stormwater management plan for Contra Costa County (the Contra Costa Clean Water Program). Under the permit, the agencies have responsibility for stormwater management and protection within their respective jurisdictions, and they may prohibit or set limits for discharges to meet water quality objectives set forth in the permit.

WATER QUALITY CONTROL PLANS

The CVRWQCB is the primary agency responsible for protecting water quality in natural waters ("waters of the State") within the Delta. The CVRWQCB's *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* ("Basin Plan") (CVRWQCB 2006) designates existing and potential beneficial uses for each water body within its geographic region, and sets numeric and narrative water quality objectives to protect the beneficial uses. The surface water objectives include goals for a wide range of factors, including dissolved oxygen, pH, sediment, toxicity, and population and community ecology. The Basin Plan includes an implementation plan for achieving the water quality objectives that describes recommended actions for public and private entities, time schedules for actions, and strategies for compliance. The designated beneficial uses, combined with the narrative and numerical water quality objectives and the implementation plan constitute water quality standards for the Central Valley Region. Existing beneficial uses for the Delta surface water and groundwater are summarized in Table 3.2-8[5]. Beneficial uses are not designated specifically for Big Break, Dutch, Emerson, and Little Dutch Sloughs. Because these water bodies are tributary to and effectively part of the Delta, beneficial uses designated for the Delta are assumed to apply. Beneficial uses designated for Marsh Creek per State Board Resolution 90-28 include water contact recreation and non-contact water recreation, warm water spawning habitat, wildlife habitat, and rare, threatened, or endangered species habitat. All groundwater at and near the site is considered a potential source of drinking water.

In addition to the Basin Plan, the Delta is also protected under the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (Bay/Delta Plan). The Bay/Delta Plan focuses

[5] Although the Basin Plan lists the beneficial uses for the Sacramento San Joaquin Delta as indicated, it also states (Table II-1, footnote 8) "beneficial uses vary throughout the Delta and will be evaluated on a case-by-case basis."

on the protection of the Estuary's beneficial uses that involve salinity (from salt water intrusion and agricultural drainage) and water project operations (reservoir releases and diversions) (SWRCB 2006). The State Board implements most of the objectives in the Bay/Delta Plan by assigning responsibilities to water rights holders, and particularly by requiring specific minimum Delta flows be maintained by dam/diversion operators (Bay/Delta Plan, pg. 23). The Bay/Delta Plan also recognizes a broad, multi-agency effort to provide better protection and support for biological resources, identifying among 14 priorities the following objective: "Implement actions needed to restore and preserve marsh, riparian, and upland habitat in and upstream of the Delta." The Bay/Delta Plan goes on to state that "State and federal agencies should require, to the extent of their authorities, habitat restoration in the Delta …as a condition of approving projects" (Bay/Delta Plan, pg. 40). Water quality objectives established in the Bay/Delta Plan are incorporated (by reference or adoption) into the Basin Plan.

The following policies are incorporated into the Basin Plan by reference and are relevant to the Dutch Slough Restoration and Ironhouse Projects:

The *Statement of Policy with Respect to Maintaining High Quality of Water in California* (State Board Resolution No. 68-60) and the associated *Antidegradation Implementation Policy* restrict the CVRWQCB and dischargers from reducing the water quality of surface or groundwater, even though such a reduction of water quality might still allow the protection of the beneficial uses associated with the water prior to the quality reduction. In application, the objective of the policy is to maintain existing high quality of waters "consistent with the maximum benefit to the people of the State."

The *Sources of Drinking Water Policy* (State Board Resolution No. 88-63) specifies that, except under specifically defined exceptions, all surface and groundwater of the state are to be protected as existing or potential sources of municipal and domestic supply. The specific exceptions include waters with existing high total dissolved solids (TDS) concentrations greater than 3000 mg/L (conductivity greater than 5,000 µS/cm; Basin Plan page II-3.00), low sustainable yield, or contamination that cannot be reasonably treated. The designation of drinking water supply can only be removed by the State Water Board through a formal Basin Plan amendment and public hearing.

The *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Board Resolution No. 2000-015), also known as the State Implementation Plan (SIP), establishes implementation provisions and certain monitoring requirements for the priority pollutant criteria promulgated by USEPA (May 2000) through the National Toxics Rule and California Toxics Rule (CTR), and for priority pollutant objectives established in the Basin Plan.

The *Nonpoint Source Management Plan* (State Board Resolution No. 88-123) establishes a three-tiered management approach for addressing nonpoint pollution source problems. These are 1) voluntary implementation of best management practices, 2) regulatory based encouragement of best management practices and3) adopted effluent limits. The policy states that the least stringent successful approach should be employed, with more stringent measures considered if timely improvements in beneficial use protection are not achieved.

The *Nonpoint Source Implementation and Enforcement Policy* (State Board Resolution No. 2004-0030) requires the State Board to regulate all nonpoint sources of pollution, using the administrative permitting authorities provided by the Porter-Cologne Act. The permitting authorities include, but are not limited to Basin Plan prohibitions, Waste Discharge Requirements, and waivers of Waste Discharge Requirements.

Table 3.2-8. Designated Beneficial Uses of the Sacramento San Joaquin Delta Surface Water and Groundwater as Defined by the Central Valley Regional Water Quality Control Board

Statewide Standard Basin Plan Beneficial Use Designations	*Sacramento San Joaquin Delta*	*Groundwater*
Municipal and Domestic Supply	Existing	Existing [6]
Agricultural Supply	Existing	Existing
Industrial Service Supply	Existing	Existing
Industrial Process Supply	Existing	Existing
Groundwater Recharge		
Freshwater Replenishment		
Navigation	Existing	
Hydropower Generation		
Water Contact Recreation	Existing	
Non-contact Water Recreation	Existing	
Aquaculture		
Warm Freshwater Habitat	Existing	
Cold Freshwater Habitat	Existing	
Estuarine Habitat		
Wildlife Habitat	Existing	
Special Significance Habitats		
Rare, Threatened or Endangered Species		
Migration of Aquatic Organisms	Existing *	
Spawning, Reproduction, and/or Early Development	Existing **	
Warm Water Spawning	Existing	

Source: Water Quality Control Plan for the Sacramento and the San Joaquin River Basins, 4th Edition
Key:
* Includes both cold water (salmon, steelhead) and warm water (striped bass, sturgeon, and shad) species
** Includes warm water species only

The *Irrigated Lands Regulatory Program* provides conditional waivers of waste discharge requirements for irrigated agricultural lands, which may include managed wetlands. The waivers will usually include the following conditions to protect water quality: 1) implement management practices to protect water, 2) comply with water quality standards, 3) conduct monitoring either individually or as part of a coalition, 4) prevent pollution of surface water, avoid nuisance conditions, such as odor, and 5) pay applicable fees..

[6] Although groundwater wells in the shallow aquifer of the Project Area typically show TDS concentrations or conductivity readings significantly greater than this standard (e.g., 800-50,000 µS/cm, Balance 2005; 650-8,000 mg/L TDS, Ironhouse 2005), the CVRWQCB regulates the shallow aquifer as a potential source of drinking water (Tom Williams, pers. comm.).

Applicable Water Quality Objectives for Surface Water

Although the Dutch Slough Restoration Project would not intentionally discharge pollutants to Waters of the State as a part of its purpose, there would be incidental discharges as a part of construction or operation, and there may be onsite conditions created that could result in the violation of some water quality objectives. It is not known at this time whether the CVRWQCB would choose to regulate all or part of the Dutch Slough Restoration Project activities under Waste Discharge Requirements, however, the following water quality objectives would generally apply:

- *Biostimulatory Substances*: Water shall not contain biostimulatory substances, which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.
- *Chemical Constituents*: Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in Title 22 of the California Code of Regulations, which are incorporated into the Basin Plan by reference. Table 3.2-9 provides the relevant MCLs for inorganic chemicals. For some organic and inorganic chemicals, the California Toxics Rule applies more conservative limits for protection of freshwater aquatic life or human health.
- *Dissolved Oxygen*: Dissolved oxygen concentration within the Delta region occupied by this Project site shall not be reduced below 5.0 mg/l.

Table 3.2-9. Maximum Contaminant Levels for Inorganic Chemicals (Title 22 CCR Section 64431)

Chemical	*Maximum Contaminant Level, mg/L*
Aluminum	1.
Antimony	0.006
Arsenic	0.01*
Barium	0.1*
Beryllium	0.004
Cadmium	0.005
Chromium	0.05
Cyanide	0.01*
Mercury	0.002
Nickel	0.1
Nitrate (as NO3)	45.
Nitrate + Nitrite (sum as nitrogen)	10.
Nitrite (as nitrogen)	1.
Selenium	0.05
Thallium	0.002

*MCL from table III-1 in the Basin Plan. More stringent than Title 22 CCR level.

- *MeHg:* The Basin Plan (4th Edition) currently includes no specific requirements for MeHg in the Delta. However, the CVRWQCB is in the process of developing a TMDL for MeHg in the Delta. While the specifics of this TMDL are currently unknown, it is expected that the program will involve a three-phase strategy. The first phase would require studies to develop MeHg control strategies, the second phase requires implementing control measures identified in the first phase, and the third phase will be the full compliance phase with the TMDL objectives.
- *Oil and Grease:* Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
- *pH:* The pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated COLD or WARM beneficial uses. In determining compliance with the water quality objective for pH, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.
- *Salinity*: [7]To protect municipal and industrial beneficial uses, the maximum mean daily concentration of chloride (Cl) shall not exceed 250 mg/L during any "water year type" (defined by the Sacramento Valley 40-30-30 water year hydrologic classification index[8]). In addition, the maximum mean daily concentration of 150 mg/L Cl shall be maintained for at least 240 days during a wet year, 190 days during an "above normal" year, 175 days during a "below normal" year, 165 days during a "dry" year, and 155 days during a "critical" year.
- *Suspended Sediment*: The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
- *Settleable Material*: Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.
- *Suspended Material*: Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
- *Temperature*: The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the CVRWQCB that such alteration in temperature does not adversely affect beneficial uses. At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.
- *Toxicity*: All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objec-

[7] According to CVRWQCB staff, Betty Yee (8/9/06), salinity objectives stated for specific "compliance points" may not be interpolated to determine the salinity standard for another point. However, dischargers may interpolate the objectives in order to determine how their discharges might affect concentrations at the compliance points. The two nearest compliance points are Contra Costa Canal at Pumping Plant #1 (Station C5), and San Joaquin River at Antioch Shipping Canal (Station D12). Table 1 of the Bay/Delta Plan defines salinity limits in terms of chloride (Cl-) concentrations for protection of municipal and industrial beneficial uses. The salinity objectives for both nearby compliance points are the same, and so they are reported directly above.

[8] Note that the objective is defined in terms of the Sacramento Valley index rather than the San Joaquin Valley index.

tive applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.

- *Turbidity*: Waters of the Delta shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Except for periods of storm runoff, the turbidity of Delta waters shall not exceed 50 NTUs in the waters of the Central Delta and 150 NTUs in other Delta waters. Exceptions to the Delta specific objectives will be considered when a dredging operation can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit.

  In addition to these Delta-specific criteria, the general turbidity goals for the Sacramento and San Jaoquin River Basins also apply. These indicate that increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

  - Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.
  - Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.
  - Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
  - Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

Applicable Water Quality Objectives for Groundwater

None of the activities of the Dutch Slough Restoration Project would directly discharge pollutants into groundwater, but some activities may cause changes in groundwater characteristics as a result of changes in surface water hydrology or placement of soils where constituents could potentially be transported into the groundwater. Since the shallow groundwater aquifer underlying the Dutch Slough Restoration Project site is designated for municipal beneficial use, the following water quality objectives generally apply:

- *Bacteria:* The most probable number of coliform organisms over any seven-day period shall be less than 2.2/100 ml.
- *Chemical Constituent*: At a minimum, groundwaters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, groundwaters shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in CCR Title 22 for inorganic chemicals, fluoride, organic chemicals, and they shall not contain lead in excess of 0.015 mg/l.
- *Taste and Odors*: Groundwaters shall not contain taste- or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.
- *Toxicity*: Groundwaters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s). This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances

Sediment Screening Criteria

The Dutch Slough Restoration Project would excavate, relocate, and potentially import soils and sediments in areas that would subsequently be inundated by natural water as part of the restoration action. There currently are no Basin Plan objectives or other regulatory criteria for sediment to protect water quality; however, there are sediment quality guidelines that may be used as screening tools. The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) developed sediment screening and testing guidelines for determining the general suitability of dredged material for beneficial reuse (wetland restoration) projects (SFRWQCB 2000; WQ Appendix I) [9]. The guidelines include sediment chemistry, acute toxicity, contaminant mobility, and elutriate chemistry and toxicity. Since the CVRWQCB has no such guidelines for sediment reuse in wetland restoration projects in the Central Valley, the SRFWQCB standards will be used as screening criteria in situations where sediment will be dredged or excavated, to evaluate the beneficial reuse options for the material and the potential adverse effects of these and other sediment disturbing activities. However, disposal of dredged or excavated material for beneficial reuse will be subject to site-specific testing requirements and acceptance requirements provided by the CVRWQCB as part of Waste Discharge Requirements for the project. The sediment screening criteria are as follows:

- *Chemistry*: The guidelines for sediment chemistry are shown in Table 3.2-10. The sediment chemistry guidelines are divided into two levels, one for material that will be placed at or near the wetland surface ("surface material") and one for material that will be placed at a minimum specified distance below the wetland surface ("foundation material").
- *Toxicity*: The recommended acute toxicity screening guideline for surface material is "no significant toxicity" for benthic bioassays. Benthic tests are to be interpreted following guidelines in SFBRWQCB Public Notice 93-3. For benthic bioassays, mortality in a test sediment that is statistically significant and 10 percentage points greater (20 percentage points for amphipods) than that in the reference is considered to be indicative of acute toxicity.
- *Contaminant Mobility*: There are no screening levels for contaminant mobility for wetland surface material because toxicity and chemistry screening for this material will result in concentrations for which mobility is not considered of concern. The screening levels for wetland foundation material are based on Water Quality Objectives found in the Basin Plan. While the foundation material is not expected to be in direct contact with biological receptors, levels of contaminants in effluent discharged during placement of material or in leachate produced after placement of material must be below levels of concern.
- *Elutriate Chemistry and Toxicity*: If dewatering will occur as part of material placement, discharge water must meet screening guidelines for both chemistry and toxicity. The screening guidelines for discharged water chemistry are the Basin Plan Water Quality Objectives listed above. The screening guideline for toxicity is "no significant toxicity". For the elutriate bioassay (the toxicity test on the water separated out from the sediment), this is met when the survival of organisms in effluent has a median value of not less than 90% and a 90th percentile value of not less than 70%.

[9] Use of these guidelines within the Central Valley Region is subject to approval by the CVRWQCB Staff. The Central Valley CVRWQCB may require different or additional criteria as part of CWA Section 401 review.

Table 3.2-10. Sediment Chemistry Screening Guidelines (from *Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines* [SFBRWQCB 2000])

ANALYTE	Wetland Surface Material		Wetland Foundation Material	
	Concentration	Decision Basis	Concentration	Decision Basis
METALS (mg/kg)				
Arsenic	15.3	Ambient Values	70	ER-M
Cadmium	0.33	Ambient Values	9.6	ER-M
Chromium	112	Ambient Values	370	ER-M
Copper	68.1	Ambient Values	270	ER-M
Lead	43.2	Ambient Values	218	ER-M
Mercury	0.43	Ambient Values	0.7	ER-M
Nickel	112	Ambient Values	120	ER-M
Selenium	0.64	Ambient Values		
Silver	0.58	Ambient Values	3.7	ER-M
Zinc	158	Ambient Values	410	ER-M
ORGANOCHLORINE PESTICIDES/PCBS (mg/kg)				
DDTS, sum	7.0	Ambient Values	46.1	ER-M
Chlordanes, sum	2.3	TEL	4.8	PEL
Dieldrin	0.72	TEL	4.3	PEL
Hexachlorocyclohexane, sum	0.78	Ambient Values		
Hexachlorobenzene	0.485	Ambient Values		
PCBs, sum	22.7	ER-L	180	ER-M
POLYCYCLIC AROMATIC HYDROCARBONS (mg/kg)				
PAHs, total	3,390	Ambient Values	44,792	ER-M
Low molecular weight PAHs, sum	434	Ambient Values	3,160	ER-M
High molecular weight PAHs, sum	3,060	Ambient Values	9,600	ER-M
1-Methylnaphthalene	12.1	Ambient Values		
1-Methylphenanthrene	31.7	Ambient Values		
2,3,5-Trimethylnaphthalene	9.8	Ambient Values		
2,6-Dimethylnaphthalene	12.1	Ambient Values		
2-Methylnaphthalene	19.4	Ambient Values	670	ER-M
2-Methylphenanthrene		Ambient Values		
3-Methylphenanthrene		Ambient Values		
Acenaphthene	26.0	Ambient Values	500	ER-M
Acenaphthylene	88.0	Ambient Values	640	ER-M
Anthracene	88.0	Ambient Values	1,100	ER-M
Benz(a)anthracene	412	Ambient Values	1,600	ER-M
Benzo(a)pyrene	371	Ambient Values	1,600	ER-M
Benzo(e)pyrene	294	Ambient Values		
Benzo(b)fluoranthene	371	Ambient Values		
Benzo(g,h,i)perylene	310	Ambient Values		
Benzo(k)fluoranthene	258	Ambient Values		
Biphenyl	12.9	Ambient Values		
Chrysene	289	Ambient Values	2,800	ER-M
Dibenz(a,h)anthracene	32.7	Ambient Values	260	ER-M
Fluoranthene	514	Ambient Values	5,100	ER-M
Fluorene	25.3	Ambient Values	540	ER-M
Indeno(1,2,3-c,d)pyrene	382	Ambient Values		
Naphthalene	55.8	Ambient Values	2,100	ER-M
Perylene	145	Ambient Values		
Phenanthrene	237	Ambient Values	1,500	ER-M
Pyrene	665	Ambient Values	2,600	ER-M

Ambient Values – Ambient or "background" concentration statistically derived by the SFBRWQCB from data collected by the Regional Monitoring Program for Trace Substances (SFEI 1999) and the Bay Protection and Toxic Substances Cleanup Program Reference Study (SWRCB 1998)

TEL, PEL – Threshold Effects Level and Probable Effects Level - Sediment chemistry values developed by the Florida Department of Environmental Protection (FDEP 1994) as those below which biological effects are unlikely (TEL), and above which biological effects are likely (PEL).

ER-L, ER-M – Effects Range-Low and Effects Range-Median – Sediment chemistry values developed by Long et al. (1995) using the sediment chemistry and toxicity database of the National Oceanographic and Atmospheric Administration as those below which biological effects are unlikely (ER-L) and above which biological effects are likely (ER-M).

Dredged materials that meet the screening guidelines described above for wetland surface reuse are likely to be found suitable for this use, as well as for all the other uses described in this paper, subject, of course, to any project-specific limitations.

Dredged materials with statistically significant toxicity in one or more bioassays may be found suitable for Wetland Foundation Reuse if the material passes the screens for sediment chemistry and contaminant mobility. Reuse of such materials would be limited (by reuse site permitting) to locations that are designed to eliminate the threat of exposure. A wetland restoration design should include at least three feet of material suitable for Wetland Surface Reuse (or equivalent safeguards) and placement of the material in a location that is not threatened by erosion.

3.2.2. Project Impacts and Mitigations

Significance Criteria

In the evaluation of project alternatives that follows, a potential impact to water quality was considered significant if the construction or foreseeable post-construction conditions would cause any of the following:

- Violation of any water quality standard indicated in the Regulatory Framework section, above, or any Waste Discharge Requirement or NPDES permit condition;
- Discharge of any toxic substances into the water in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota;
- Degradation of the existing high quality of water in any waters of the State, in violation of the Anti-degradation Policy; or
- Any change of water quality that would adversely affect designated beneficial uses.

Evaluation of Alternatives

This section considers each of the four Dutch Slough Restoration Project alternatives to determine whether any component of the alternative may result in significant impacts to water quality during or after project construction. If potential impacts are identified, mitigation measures are described that would reduce the impact, ideally to less than significant levels. In some cases, water quality impacts could potentially occur that would also involve impacts to fish or wildlife. In these cases, the water quality impact and mitigation will be addressed herein, and reference is made to other appropriate sections (e.g., Section 3.5, *Aquatic Resources*) for additional evaluation.

An important aspect of the Dutch Slough Restoration Project is that it has been designed with the specific intent of creating an environmentally beneficial project that would have minimal adverse affects; therefore many "mitigations" for potential water quality impacts have already been incorporated into the Dutch Slough Restoration Project design. This evaluation considers any mitigation that is already a part of the design to be a part of the project being assessed unless the implementation of the measure may be optional or discretionary.

Under Alternatives 2 and 3 material would be transported from the Ironhouse parcel and used as fill for the main project site. Under Alternative 1 restoration activities on the Ironhouse parcel may affect water quality in Marsh Creek.

Alternative 1: Minimum Fill

IMPACT 3.2.1-1: DEGRADATION OF WATER QUALITY DUE TO RELEASE OF CONTAMINANTS AND SEDIMENT FROM CONSTRUCTION ACTIVITIES (DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS)

Construction activities such as site clearing, grading, excavation, tide gate installation, demolition, reconstruction of existing facilities, or levee breaching, lowering, or building, could leave soils exposed to rain or surface water runoff[10] that may carry soil contaminants (e.g., nutrients, metals, hydrocarbons, or other pollutants) into waterways adjacent to the site, degrade water quality, and potentially violate water quality standards for specific chemicals, dissolved oxygen, oil and grease, suspended sediment, or toxicity. Alternative 1 would entail the least amount of surface disturbance for excavation of the Ironhouse parcel (which would be only slightly graded because it would not have to supply fill material to the Dutch Slough Restoration Project) and for grading or channel construction on all parcels, and so it would pose the lowest level of risk of this kind of impact. However, demolition and construction for the City Community Park, trails, and marsh areas would still be substantial, and overall potential impact to water quality could still be significant.

OPEN WATER MANAGEMENT OPTIONS

The deep subtidal option would entail more excavation and moving of soils on the site, increasing the risk of contaminated runoff by (1) potentially digging up additional areas of contaminated soils that would otherwise remain buried, and (2) increasing the area of disturbed soil subject to runoff. The skeletal channel option would require import and placement of large amounts of additional fill, increasing the risk of contaminated runoff by (1) increasing the area of disturbed soil subject to runoff, and (2) bringing in imported soils that could contain additional contaminants. The managed pond option would entail the same level of impact as the shallow subtidal open water option, but it potentially would have slightly reduced risk because flows could be regulated via the tide gate to allow remediation of contaminated soils or water prior to discharge. The subsidence reversal option would be similar to the managed pond in impact and risk, but it could potentially provide additional water quality benefit by serving as a stormwater "treatment wetland" for runoff for other parts of the project site.

MITIGATION 3.2.1-1.1: STORM WATER POLLUTION PREVENTION PLAN

A Stormwater Pollution Prevention Plan (SWPPP) shall be prepared prior to any construction on any portion of the Project, and implemented during construction. Individual SWPPPs may be prepared for various construction components or phases (e.g., demolition of existing site structures, grading of one parcel, etc.). The SWPPP(s) shall be prepared according to requirements of the State's Construction Activities Storm Water Permit (Construction Permit; State Board Order No. 99-08-DWQ, NPDES Permit CAS000002), following guidance contained in Section A of that permit, and it shall include all appropriate best management practices (BMPs) for minimizing stormwater runoff and the potential pollution it may cause. Coverage shall be obtained under the Construction Permit by filing a Notice of Intent and fee prior to construction of any project component.

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[10] By its very nature, the Project would intentionally bring surface water in contact with exposed soils, as the site is inundated as part of the restoration plan.

MITIGATION 3.2.1-1.2: DEWATERING RESTRICTION

Ponded storm or groundwater in construction areas shall not be dewatered directly into adjacent surface waters or to areas where they may flow to surface waters unless authorized by a permit from the CVRWQCB. In the absence of a discharge permit, ponded water (or other water removed for construction purposes), shall be pumped into baker tanks or other receptacles, characterized by water quality analysis, and remediated and/or disposed of appropriately based on results of analysis. If determined to be of suitable quality, some of this water may be used on-site for dust control purposes.

MITIGATION 3.2.1-1.3: CONTRACTOR TRAINING FOR PROTECTION OF WATER QUALITY

All contractors that will be performing demolition, construction, grading, road building, or other work that could cause increased water pollution conditions at the site (e.g., dispersal of contaminated soils, oiling of access roads) will receive training regarding the environmental sensitivity of the site and need to minimize impacts. Contractors will also be trained in implementation of stormwater BMPs for protection of water quality.

MITIGATION 3.2.1-1.4: MINIMIZE POTENTIAL POLLUTION CAUSED BY INUNDATION OF SITE

Sites shall not be inundated (connected to tidal water sources) until surface soil conditions have been stabilized, all construction debris removed, and all surface soils containing chemicals in excess of the Sediment Screening Criteria for "surface material" have been remediated or removed from the site.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.1-2: DEGRADATION OF WATER QUALITY DUE TO INCREASED DISSOLVED ORGANIC CARBON (DOC) IN DELTA WATERS (DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS)

Alternative 1 would create approximately 440 acres of tidal marsh and 480 acres of shallow subtidal habitat, which is expected to result in production and export of organic carbon as part of natural, and typically desirable, wetland processes. While organic carbon is considered a critical foundation for the aquatic food chain (see discussion of San Joaquin-Sacramento Delta Water Quality, above), the dissolved fraction of organic carbon (DOC) can adversely impact drinking water sources by increasing production of trihalomethanes and other by-products during water disinfection. The Dutch Slough Restoration Project is located approximately ten water-miles from the Rock Slough intake to the Contra Costa Canal (see Figure 3.2-2), and so the potential export of organic carbon was raised as a concern by the Contra Costa Water District. Source water from Rock Slough is an important untreated water supply source during wet months, when salinity levels in the Delta are low. Supplies diverted through the canal also are used to blend with Los Vaqueros Reservoir water during dry months and droughts, when salinity levels are higher in the Delta.

There are currently no water quality objectives for DOC or total organic carbon (TOC) for the western Delta. However, the State Water Board suggests a goal of average total organic carbon (TOC) concentrations of 3.0 mg/L at drinking water intakes in the southern and central Delta (SWRCB 2006). The CVRWQCB is in the process of developing a new policy to protect sources of drinking water and appropriate levels of DOC are one of the chief concerns that will be addressed. It is unlikely that the CVRWQCB would choose to view export of organic carbon from a restored wetland system as a violation of the Antidegradation Policy, since organic carbon for the food chain is one of the primary objectives of wetland restoration and it supports a key beneficial use of Delta waters. However, if there were substantial reason to believe that carbon export from the Project could adversely affect water quality at the Contra Costa Canal intake, the CVRWQCB could choose to address it via Waste Discharge Requirements that specified site specific objectives or mandated specific management actions. Also, it would be considered a significant impact under this evaluation if the condition were to result in a "change of water quality that would adversely affect designated beneficial uses" (Section 3.2.2.1, above), whether or not a water quality objective were actually violated.

Whether the organic carbon produced by the restored marshes on the Dutch Slough Project site could adversely affect the drinking water source at the Rock Slough intake would depend on the character of the organic carbon (e.g., the percent in dissolved or otherwise reactive form) and whether it could reach the Rock Slough intake in sufficient concentration to be discernable from "background" levels. According to USGS, the best estimate for export of [total] organic carbon from tidal wetlands is 150 grams carbon per square meter per year (Brown 2003, citing Jassby and Cloern 2000). However, the percentage of this carbon that may be reactive and form disinfection byproducts (such as trihalomethanes) is dependent on many factors, including type of soil, amount of vegetation, wetland construction method, and age of the wetland (Brown 2003, Orr et al. 2003). A study of carbon production on flooded Delta islands found that the initial rate of flux of DOC into the water column was very high (0.6 g DOC/m^2/day) accounting for 84-98% of the total carbon. This rate of flux decreased markedly over two years to 0.15 g DOC/m^2/day, as did the relative fraction of carbon in the dissolved state (Reddy 2005).

Using the TOC and DOC export estimates of Jassby and Cloern (2000) and Reddy (2005), respectively, the following rough estimates can be made for carbon export from the 440 acres of marsh and 480 acres of shallow subtidal habitat created in Alternative 1: (1) the "steady state" export of TOC from the marsh may be about 1.7 tons TOC/day; (2) the export of DOC from the site may be as high as 2.5 tons DOC/day initially, and may decrease to 0.6 tons DOC/day after two years. Depending on the DOC concentrations with respect to CCWD's water intake, this may be a significant impact to water quality.

The total area of the Ironhouse parcel that would be inundated and thus become an exporter of organic carbon is not specified in the plan. For evaluation purposes, it was estimated that 75% of the 100-acre property, or 75 acres, would be inundated. Applying the TOC and DOC export estimates of Jassby and Cloern (2000) and Reddy (2005), respectively, the following rough estimates can be made for carbon export from the 75 acres if tidal marsh habitat created by the Ironhouse Project: (1) the "steady state" export of TOC from the marsh may be about 0.1 tons TOC/day; (2) the export of DOC from the site may be as high as 0.2 tons DOC/day initially, and may decrease to 0.05 tons DOC/day after two years.

Total and dissolved organic carbon exported from the park site would be consistent with typical urban runoff, and would not be expected to be significantly higher than under current conditions (current agricultural uses generate similar levels of organic carbon).

Finally, in order for DOC generated at the Dutch Slough Restoration Project to reach the water supply intakes at Rock Slough, it would have to be transport ten miles upstream through tidal channels – first north into Dutch Slough, eastward six miles into Old River, and southward another five miles, then more than a mile westward into the Rock Slough Intake. A permanent tide gate on San Mound Slough prevents Dutch Slough Water from reaching Rock Slough more directly via Sand

Mound Slough. Although it is possible for DOC to move upstream in a tidal environment, the quantity of DOC reaching the Rock Slough intake when the canal is operating is likely to be small. Furthermore, the extent of mixing across this transport distance would substantially dilute DOC concentrations from Dutch Slough given the very small tidal prism of the restoration project compared to the very large volume of water into which restoration site waters would mix. The likely transport and dilution of DOC from Dutch Slough to Rock Slough, however, has not been calculated.

OPEN WATER MANAGEMENT OPTIONS

The deep subtidal option would presumably produce a similar loading of TOC, but may have a slightly higher fraction of DOC. The skeletal channel option would have reduced area functioning to produce TOC, and the carbon produced would perhaps tend to have a lower fraction of DOC. The managed pond option would have little or no export of organic carbon. The subsidence reversal option would delay export of organic carbon for the period of time that the site was operated as a non-tidal system. When the site was ultimately opened for tidal inundation, export of organic carbon would initiate. The type and quality of the carbon would be determined by the type of substrate that had developed over time, with peat soils causing the highest fraction of reactive dissolved organic carbon.

"NO BURROUGHS" OPTION

The "no Burroughs" option would decrease acreage of tidal marsh from approximately 390 acres to approximately 180 acres. A relative decrease in TOC and DOC would be expected and may reduce this impact to less than significant.

MITIGATION 3.2.1-2.1: REFINE MODEL FOR EXPORT AND TRANSPORT OF TOC AND DOC PRIOR TO INITIATING TIDAL FLOW.

More precise estimates of marsh and open water areas and tidal flow volumes and transport to the Rock Slough intakes would be developed as the project design proceeds. These improved values shall be used to better estimate the potential TOC and DOC export from the site (using the Jassby and Cloern and Reddy models or others). During this time the monitoring program will also get underway, and TOC and DOC concentrations in the sloughs adjacent to the site, at the entrance to Rock Slough, and at the CCWD intakes will be measured. The refined export estimates shall be compared to the measured TOC and DOC values at the monitored points and these loads can be converted to concentrations by considering diurnal tide, with flushing from tidal marsh channels to Dutch Slough. If the predicted concentrations are at or below levels observed at the CCC intake, it can be stated that no significant impact from DOC is expected. If concentrations are at or above levels observed at the CCC intake, then hydrodynamic modeling would be employed to evaluate transport from the site to the CCC intake to determine dilution between project and intake.

MITIGATION 3.2.1-2.2: PHASE RESTORATION OF PARCELS

If the estimates from mitigation 3.2.1-2.1, above, show a potential significant impact, restoration of tidal flows to parcels shall be phased over several years to reduce the amount of DOC exported from the project to a level that will not adversely impact water quality at the Rock Slough intake.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.1-3: OPERATIONAL DEGRADATION OF WATER QUALITY DUE TO INCREASED EROSION AND TURBIDITY (DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND OPEN WATER MANAGEMENT OPTIONS)

Increased erosion that could occur from operation of the Dutch Slough and Ironhouse restoration projects are described in Section 3.1, Hydrology and Geomorphology. As described in that section, project elements that could result in post-construction erosion and increased turbidity include levee breaches and skeletal marsh channels. Erosion and increased turbidity also could occur in Dutch, Emerson and Little Dutch Slough (especially southern Little Dutch Slough if not enlarged), and Marsh Creek; this impact is addressed in Impact 3.1.1-1 in Section 3.1, Hydrology and Geomorphology. Secondary water quality impacts due to elevated turbidity could include increased temperature and lower DO. In addition, the Project could result in temporary impacts to water quality parameters (turbidity, temperature, pH, DO) if increased erosion occurs as design elements adjust to restoration hydrology and revegetation. Increased turbidity may have benefits to Delta Smelt (see Chapter 3.5, Aquatic Resources).

"NO BURROUGHS" OPTION

In the "no Burroughs" option, tidal breaches would occur on Emerson Slough rather than Little Dutch Slough. Turbidity impacts are likely to be similar, though there is the potential for less erosion in Emerson Slough because it is a wider slough at its southern end. The potential need for dredging Emerson Slough has not been assessed.

MITIGATION 3.2.1-3: DREDGE LITTLE DUTCH SLOUGH

As described in Section 3.1, any channel erosion is expected to occur over time and should not greatly increase turbidity. Dredging to enlarge southern Little Dutch Slough could reduce sediment input from scour that would occur otherwise. Mitigation measures for Impact 3.1-1.1 also would apply to this impact.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.1-4: POTENTIAL DEGRADATION OF WATER QUALITY DUE TO INCREASED MERCURY METHYLATION (DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS)

As discussed above, mercury methylation is a concern for wetland restoration projects in the Bay-Delta because certain types of wetland habitats are known to support the bio-geochemical processes that transform mercury into MeHg. Total mercury should not change as a result of the Dutch Slough Restoration Project, however, there could be increase in MeHg loads to water in Dutch Slough or Big Break, as well as localized increased concentrations of MeHg in sediment.

The mercury that could potentially be converted into MeHg can be attributed to two sources at the Dutch Slough site. The first source is "ambient" mercury in the waters of the Delta, which may come from any number of sources that are combined and mixed together. The second source is the more direct input of mercury from upstream sources, particularly the abandoned mercury mine, in the Marsh Creek watershed. Preliminary data indicate that there is currently little transport of mercury below the Marsh Creek reservoir. However it is possible that high flow events or a failure of the dam could move mercury contaminated sediments out of the reservoir to the lower reaches. While there are no actions associated with the Dutch Slough Restoration Project that can address ambient mercury levels including possible Marsh Creek Reservoir dam failure, certain measures may be taken to reduce the potential impacts of mercury supplied from Marsh Creek. If Marsh Creek were routed onto the Dutch Slough site, it could increase the load of mercury, potentially increasing MeHg leaving the site. This would be a potentially significant impact.

In terms of the Ironhouse restoration parcel, the connection to Marsh Creek has been designed in a manner to minimize the potential for mercury from Marsh Creek to enter the site, thereby reducing the potential for mercury to be introduced via water or sediment sources. The connection to Marsh Creek is positioned as far downstream as possible and in such a position that water most easily enters the parcel during a flood tide, when Marsh Creek water is most diluted.

Certain aquatic habitats are more likely than others to transform mercury into MeHg. Irregularly inundated areas such as tidal high marsh zones and floodplains seem to have the highest rates of MeHg export while more regularly inundated tidal marshes and open water habitats appear to have the lowest rates of flux. Since the amount of high marsh habitat being created is minimal, the amount of MeHg exported from the Dutch Slough Restoration Project may be negligible. The width of the 5:1 slope levees and natural transitions to uplands by about 1 ft vertical range of restored marsh by about 5 miles of edge at most equates to about 3 acres total of high marsh out of 440 to 830 acres of restored marsh depending on alternative. While all of the restored marsh area has some probability fo methylating mercury, creation of landscapes anticipated to have the highest probability of methylating mercury amounts to roughly 0.7% of the restored marsh area at most. Natural evolution of the low and mid marsh to high marsh is anticipated to be a fairly slow process due to the low sediment supply in the surrounding surface waters, so formation of greater area of high marsh is anticipated to be quite slow. For these reasons, this impact is considered not significant.

OPEN WATER MANAGEMENT OPTIONS

Since many of these options are "experimental" it is hard to predict how they will impact MeHg production. The environmental factors that promote the production of MeHg (high organic matter content, low DO, high temperature, irregular inundation) would be more enhanced in the skeletal channel network option than in the deep subtidal option. In the non-tidal management options, subsidence reversal would be more likely to promote mercury methylation than managed pond since it would produce high organic matter, low DO, and high temperature conditions. These areas, however, are expected to remain submerged for extended periods with little if any periods of dry, thereby providing conditions that are apparently less likely to produce and export MeHg.

MONITORING PROGRAM

CALFED and the project partners have funded several years of baseline monitoring studies to determine the existing levels of methyilmercury in bio-sentinel organisms (fish). DWR's water quality monitoring program, discussed in the Setting section, above, will continue bio-sentinel monitoring along with measurements of MeHg levels in water and sediments in the Dutch Slough vicinity both before and after restoration activities take place. This monitoring would provide baseline conditions at the site and would allow for comparisons between pre and post restoration MeHg levels. The information would aid in determining potential site management changes in the future, as well as advance the general body of knowledge on the subject of MeHg creation and export in restored tidal marshes. It is likely that these monitoring activities will be coordinated with the creation of the Delta Mercury TMDL.

The water quality monitoring plan also will include monitoring for mercury and MeHg levels in Marsh Creek.

Mitigation 3.2.1-4: Potential prohibition of diversion of Marsh Creek onto Ironhouse parcel

Should the monitoring program study find that mercury levels are outside the acceptable range, diverting Marsh Creek onto the Ironhouse Parcel may be prohibited.

Significance after Mitigations

Less than significant with mitigation.

Impact 3.2.1-5: Degradation of Drinking Water Quality Due to Alteration to Salinity Levels in Delta Waters

Dutch Slough Restoration Project and Related Projects

As described in Impact 3.1.1-1, larger open water areas in Alternative 1 may result in greater tidal prism and more inputs of Bay water. This could potentially cause small increases in salinity in the Delta by increasing tidal flows from the Bay. Increased Delta salinities could negatively impact drinking water and irrigation water quality. However, given the distance from the project site to drinking water intakes, this impact is expected to be less than significant. In addition, mitigations for Impact 3.5.1-2, Aquatic resources, would further reduce this potential impact.

Open Water Management Options

It is possible that the deep subtidal alternative could increase tidal prism but probably insignificantly compared to other open water management options.

"No Burroughs" Option

The "no Burroughs" option, which would decrease the acreage of tidal marsh by approximately half, would decrease the tidal prism and reduce the risk of increased salinity in the Delta.

Significance after Mitigations

Less than significant with or without mitigation.

Impact 3.2.1-6: Degradation of Water Quality Due to Increased Salinity Concentrations in the Contra Costa Canal (from Elevated Groundwater)

Dutch Slough Restoration Project and Related Projects and Open Water Management Options

See discussion of Impact 3.1.1-5, Possible Water Quality Degradation in Contra Costa Canal due to Groundwater Seepage.

Mitigation

See mitigation for Impact 3.1.1-5, Groundwater Intrusion Study and Remediation.

Significance after Mitigation

Less than significant with mitigation.

IMPACT 3.2.1-7: DEGRADATION OF WATER QUALITY DUE TO ELEVATED METALS, ENDOCRINE DISRUPTING CHEMICALS, OR OTHER POLLUTANTS

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND OPEN WATER MANAGEMENT OPTIONS

Wastewater that may contain endocrine disrupting chemicals (EDCs) reaches the project area from two sources: the Brentwood Wastewater Treatment Plant (BWWTP) tertiary treated wastewater that is discharged into Marsh Creek and the Ironhouse Sanitary District wastewater that is sprayed onto the Ironhouse parcel.

Development of the Ironhouse Project would disturb soil on that parcel and may liberate contaminants (including potential EDCs) into the restored Marsh Creek Delta. This would be a temporary effect that might release a small amount of contaminants and is not considered significant.

Metals and other contaminants at levels exceeding regulatory criteria were not found in investigations of the Ironhouse parcel soil; therefore, no impact would occur from excavation and replacement of that material on the Ironhouse parcel (Stellar Environmental Solutions, 2006). The results of the soil investigation also indicate that the spatial variation in contaminants is low enough that no further sampling is necessary before soils are excavated and reused.

While tertiary treated wastewater is usually free from harmful levels of most common pollutants, many EDCs are not effectively removed. The Dutch Slough site would receive some input of these pollutants from the BWWTP via Marsh Creek even without it being routed directly onto the property since the mouth of the creek is adjacent to the site. The Ironhouse parcel however would be directly exposed to these substances since Marsh Creek would be routed directly onto it. As described the Setting, water samples have not been analyzed for EDCs and no regulatory criteria have been established for many of the potential contaminants. Therefore, a definitive assessment of the significance of these impacts is not possible at this time and, as a reasonable worst-case assumption, the impact is considered potentially significant.

MITIGATION 3.2.1-7: MARSH CREEK WATER QUALITY TESTING AND EVALUATE FEASIBILITY OF MARSH CREEK RELOCATION BASED ON WATER QUALITY CONSIDERATIONS

If and when the RWQCB establishes criteria for EDCs of concern, the Marsh Creek water-quality testing program described in Mitigation 3.2.1-4 shall be expanded to include these compounds. Marsh Creek shall not be relocated if EDC levels exceed acceptable criteria.

IMPACT SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation.

IMPACT 3.2.1-8: CUMULATIVE IMPACTS

The Dutch Slough restoration project would take place in an area that is experiencing rapid urbanization. Several housing developments immediately adjacent to the site are either currently under construction or are scheduled to begin construction soon. The Ironhouse Sanitary District (ISD) is planning to expand its sewage treatment capacity from 2.6 million gallons/day (MGD) to 4.3 MGD (phase 1) and 8.6 MGD (phase 2) to accommodate the new housing developments. The ISD also plans to eliminate its land-based wastewater irrigation on the mainland and construct a surface water discharge with tertiary treatment downstream of Jersey Point (on Jersey Island). The CVRWQCB adopted an NPDES permit (Order No. R5-2008-0057) on 25 April 2008 authorizing a surface water discharge from the wastewater treatment plant.

These proposed developments could have potential impacts on water quality in the Dutch Slough site and the greater project vicinity. The new housing developments could impact water quality in several ways. During construction of these developments, there could be increased pollution as described in impact 3.2.1-1. Due to a greater amount of impervious surfaces, these new housing developments will cause more stormwater runoff laden with the contaminants common in urban/suburban areas (i.e., pesticides, lawn fertilizers, hydrocarbons). The increased volume of municipal sewage from the new developments would introduce more pollutants to the waters, which could exacerbate Impact 3.2.1-7 above. The method in which the treated wastewater is discharged would determine the severity of the impact to water quality. More pollutants will be introduced if the effluent is discharged to surface waters as opposed to being used for irrigation on Jersey Island.

The implementation of the Dutch Slough Restoration Project could affect these new housing developments through the impacts to drinking water quality listed above. However, the mitigations offered should reduce the impacts to less than significant levels. There is also a plan to encase up to almost four miles of the Contra Costa Canal, which would eliminate impact 3.2.1-6 by severing the hydraulic connection between the Contra Costa Canal and the Dutch Slough site.

Maintenance of the City's Community Park would involve the use of herbicides and pesticides that may be washed into the wetland restoration area. Similarly, oil, grease and heavy metals may be washed into the wetlands and sloughs from the proposed Community Park parking lots and roadways. This could result in a significant impact to receiving water quality.

The impacts to water quality due to potential sea level rise must also be considered. A variety of estimates quantify the range of potential sea level rise, report observed trends and offer predictions of global warming and the potential impacts (IPCC 2001, CCCC 2006). The Intergovernmental Panel on Climate Change reports that over the last 100 years the eustatic (globally averaged) sea level rise was 1 to 2 mm/year (0.3 to 0.6 ft/century). The IPCC projects rates of sea level rise to increase over the next century, with projected increases ranging from 0.4 - 2.9 ft by 2100 (IPCC 2001). More recent estimates by the California Climate Change Center report sea level rise in California over the past century to be approximately 7 inches (0.6 ft), and projects increases of 22 to 35 inches (1.8 to 2.9 ft) by 2100 (CCCC 2006). Increases in sea level would affect water quality primarily by raising the water table and by the intrusion of more saline water from the Bay. This phenomenon would exacerbate impacts 3.2.1-5 and 3.2.1-6.

MITIGATION 3.2.1-8

Mitigations identified for Impacts 3.2.1-1 to 7, above as well as those identified in the Hydrology (Sea Level Rise) sections would reduce the Dutch Slough Restoration project's contributions to cumulative impacts to less than significant levels.

Alternative 2: Moderate Fill Alternative

Alternative 2 has two main differences with Alternative 1. First, it includes placement of fill within the restoration parcels in order to bring site elevations closer to suitable intertidal elevations for tidal marsh restoration. Second, it includes options to relocate Marsh Creek into the Emerson Parcel.

IMPACT 3.2.2-1: DEGRADATION OF WATER QUALITY DUE TO RELEASE OF CONTAMINANTS AND SEDIMENT FROM CONSTRUCTION ACTIVITIES

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND OPEN WATER MANAGEMENT OPTIONS

Impacts would be similar to those described for Alternative 1, but with the potential for greater impact due to increased imported fill and grading.

MARSH CREEK DELTA RELOCATION

Impact and mitigation for Marsh Creek Delta Relocation would be the same as for the rest of the project as described in Alternative 1.

MITIGATIONS

Mitigations 3.2.1-1.1, 2, 3, and 4 also would apply to this Alternative.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.2-2: DEGRADATION OF WATER QUALITY DUE TO INCREASED DISSOLVED ORGANIC CARBON (DOC) IN DELTA WATERS

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS

Alternative 2 would create approximately 660 acres of tidal marsh and 210 acres of shallow subtidal habitat, which would result in production and export of organic carbon as part of natural, and typically desirable, wetland processes.

Using the TOC and DOC export estimates of Jassby and Cloern (2000) and Reddy (2005), respectively, the following rough estimates can be made for carbon export from the 660 acres of marsh and 210 acres of shallow subtidal habitat created in Alternative 2: (1) the "steady state" export of TOC from the marsh may be about 1.6 tons TOC/day; (2) the export of DOC from the site may be as high as 2.3 tons DOC/day initially, and may decrease to 0.58 tons DOC/day after two years. These quantities are slightly greater than those projected to be generated by Alternative 1.

Impacts for the Related Projects would be the same as Alternative 1.

OPEN WATER MANAGEMENT OPTIONS

Same as Alternative 1

MARSH CREEK DELTA RELOCATION OPTIONS

There would be no significant change in TOC from the Marsh Creek Delta relocation options.

MITIGATIONS

Mitigations 3.2.1-2.1, 2, and 3 also would apply to this alternative.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

Impact 3.2.2-3: Degradation of Water Quality Due to Increased Erosion and Turbidity After Construction

Dutch Slough Restoration Project and Related Projects and Open Water Management Options

Impacts would be similar to those described for Alternative 1, but with the potential for more erosion and sediment due to increased channel network, fill, and grading.

Marsh Creek Delta Relocation Options

Restoration on Emerson Parcel will be designed as a delta so localized deposition should occur from upstream sediment inputs but any increase in turbidity in other water bodies should be less than significant.

Mitigations

Same as Alternative 1

Significance After Mitigation

Less than significant with mitigation

Impact 3.2.2-4: Potential Degradation of Water Quality Due to Increased Mercury Methylation

Dutch Slough Restoration Project and Related Projects

Impacts would be similar to those described for Alternative 1.

Open Water Management Options

Same as Alternative 1

Marsh Creek Delta Relocation Options

Diverting Marsh Creek to the project area could cause mercury deposition in marsh and open water areas, especially in Ironhouse or Emerson parcels (depending on design), to the extent that mercury is present in waters and suspended sediments in Marsh Creek. Loads of total mercury to marsh areas could increase MeHg production.

The water quality monitoring plan described in Appendix C-2 of the 2006 Dutch Slough Feasibility Report (PWA 2006) includes monitoring for mercury and MeHg levels in Marsh Creek. Should the study find that mercury levels are outside the acceptable range, diverting Marsh Creek onto the Emerson Parcel may be prohibited.

Impact 3.2.2-5: Degradation of Drinking Water Quality Due to Alteration to Salinity Levels in Delta Waters

All Options

Impacts would be similar to with Alternative 1 however the smaller open water areas of Alternative 2 could result in reduced tidal prism and less input of Bay Water. However, given the distance from the Dutch Slough area to drinking water intakes, this impact is expected to be less than significant. In addition, mitigations for Impact 3.5.1-2, Aquatic resources, would further reduce this potential impact.

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.2-6: DEGRADATION OF WATER QUALITY DUE TO INCREASED SALINITY CONCENTRATIONS IN THE CONTRA COSTA CANAL

ALL OPTIONS

See discussion of Impact 3.1.2-5

MITIGATIONS

See mitigations for Impact 3.1.2-5

SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation

IMPACT 3.2.2-7: DEGRADATION OF WATER QUALITY DUE TO ELEVATED METALS, ENDOCRINE DISRUPTING CHEMICALS, OR OTHER POLLUTANTS ON IRONHOUSE PARCEL.

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND OPEN WATER MANAGEMENT OPTIONS

This is the same as Impact 3.2.1-7 except that Alternative 2 proposes that the soil from the Ironhouse parcel be used as fill on the Dutch Slough parcels, therefore potential for contamination on the Dutch Slough site would exist. However, metals and other contaminants at levels exceeding regulatory criteria were not found in investigations of the Ironhouse parcel soil therefore no significant impact is anticipated from excavation and replacement of that material on the Dutch Slough site. Marsh Creek Relocation Options

MARSH CREEK RELOCATION OPTIONS

If Marsh Creek were relocated onto the Dutch Slough site, contaminants could reach the restored Dutch Slough site directly rather than the potential for these contaminants to enter Dutch Slough first then be transported by the tides into the Dutch Slough site.

MITIGATION

Same as Alternative 1. If Marsh Creek water quality is found to be below acceptable standards, relocating Marsh Creek onto the Dutch Slough Site may not be an option.

SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation

IMPACT 3.2.2-8: CUMULATIVE IMPACTS

Same as Alternative 1

Alternative 3: Maximum Fill Alternative

This alternative proposes the most fill placement within the restoration parcels and thus the smallest tidal prism. Marsh Creek delta relocation options are part of this alternative, as they are for Alternative 2.

Impact 3.2.3-1: Degradation of Water Quality Due to Release of Contaminants and Sediment from Construction Activities

Dutch Slough Restoration Project and Related Projects and Open water Management Options

Impacts would be similar to those described for Alternatives 1 and 2, but with the potential for greater impact due to increased imported fill and grading.

Marsh Creek Delta Relocation

Impact and mitigations for Marsh Creek Delta Relocation would be the same as described for Alternative 2.

Mitigation

Mitigations 3.2.1-1.1, 2, 3, and 4 also would apply to this Alternative.

Significance after Mitigation

Less than significant with mitigation

Impact 3.2.3-2: Degradation of Water Quality Due to Increased Dissolved Organic Carbon (DOC) in Delta Waters

Dutch Slough Restoration Project and Related Projects

Alternative 3 would create approximately 830 acres of tidal marsh and 110 acres of shallow subtidal habitat. Using the TOC and DOC export estimates of Jassby and Cloern (2000) and Reddy (2005), respectively, the following rough estimates can be made for carbon export for Alternative 3: (1) the "steady state" export of TOC from the marsh may be about 1.7 tons TOC/day; (2) the export of DOC from the site may be as high as 2.5 tons DOC/day initially, and may decrease to 0.62 tons DOC/day after two years. These quantities are slightly greater than those projected to be generated by Alternatives 1 and 2.

The impacts for the Related Projects would be the same as Alternative 1.

Open Water Management Options

Same as Alternative 1

Marsh Creek Delta Relocation Options

There would be no significant change in TOC from the Marsh Creek Delta relocation options.

Mitigations

Mitigations 3.2.1-2.1, 2, and 3 also would apply to this alternative.

Significance after Mitigations

Less than significant with mitigation.

IMPACT 3.2.3-3: DEGRADATION OF WATER QUALITY DUE TO INCREASED EROSION AND TURBIDITY AFTER CONSTRUCTION

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND OPEN WATER MANAGEMENT OPTIONS

Impacts would be similar to those described for Alternatives 1 and 2, but with the potential for more erosion and sediment due to increased channel network, fill, and grading.

MARSH CREEK DELTA RELOCATION OPTIONS

Same as Alternative 2

MITIGATIONS

Same as Alternative

SIGNIFICANCE AFTER MITIGATIONS

Less than significant with mitigation

IMPACT 3.2.3-4: POTENTIAL DEGRADATION OF WATER QUALITY DUE TO INCREASED MERCURY METHYLATION

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS

Impacts would be similar to those described for Alternative 1.

OPEN WATER MANAGEMENT OPTIONS

Same as Alternatives 1 and 2

MARSH CREEK DELTA RELOCATION OPTIONS

Same as Alternative 2

IMPACT 3.2.3-5: DEGRADATION OF DRINKING WATER QUALITY DUE TO ALTERATION TO SALINITY LEVELS IN DELTA WATERS

ALL OPTIONS

Same as Alternative 1

MITIGATION

Same as Alternative 1

SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation

IMPACT 3.2.3-6: DEGRADATION OF WATER QUALITY DUE TO INCREASED SALINITY CONCENTRATIONS IN THE CONTRA COSTA CANAL (FROM ELEVATED GROUNDWATER)

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND ALL OPTIONS

See discussion of Impact 3.1.2-5

MITIGATION

See mitigations for Impact 3.1.2-5

SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation

IMPACT 3.2.3-7: DEGRADATION OF WATER QUALITY DUE TO ELEVATED METALS, ENDOCRINE DISRUPTING CHEMICALS, OR OTHER POLLUTANTS ON IRONHOUSE PARCEL.

DUTCH SLOUGH RESTORATION PROJECT AND RELATED PROJECTS AND ALL OPTIONS

This impact would be the same as 3.2.2-7

MITIGATION

Same as Alternative 1

IMPACT SIGNIFICANCE AFTER MITIGATION

Less than significant with mitigation

IMPACT 3.2.3-8: CUMULATIVE IMPACTS

Same as Alternative 1

Alternative 4: No Project Alternative

IMPACT 3.2.4-1: DEGRADATION OF WATER QUALITY DUE TO RELEASE OF CONTAMINANTS AND SEDIMENT FROM CONSTRUCTION ACTIVITIES

Minor erosion and sedimentation would occur with ongoing agricultural activities. This impact would not be significant and not require any mitigation.

IMPACT 3.2.4-2: DEGRADATION OF WATER QUALITY DUE TO INCREASED DISSOLVED ORGANIC CARBON (DOC) IN DELTA WATERS

The site would continue to have excess irrigation and storm water pumped off site into Emerson, Little Dutch, and Dutch Sloughs. Such agricultural drainage has been identified as the predominant source of trihalomethanes forming DOC in the Delta. This is not considered a significant impact because it is no change from existing conditions.

Table 3.2-11: Summary of Potential Water Quality Impacts for Dutch Slough Restoration Project and Related Projects

	Impact Description	Dutch Slough Restoration Project	Related Projects	
			Ironhouse Project	City Community Park Project
Alternatives 1, 2, 3	Impact 3.2.1-1: Degradation of water quality due to release of contaminants and sediment from construction activities	X	X	X
	Impact 3.2.1-2: Degradation of water quality due to increased dissolved organic carbon (DOC) in Delta waters	X	X	X
	Impact 3.2.1-3: Operational degradation of water quality due to increased erosion and turbidity	X	X	
	Impact 3.2.1-4: Potential degradation of water quality due to increased mercury methylation	X	X	
	Impact 3.2.1-5: Degradation of water quality due to alteration to salinity levels in Delta waters	X	X	
	Impact 3.2.1-6: Degradation of water quality due to increased salinity concentrations in the Contra Costa Canal (from elevated groundwater)	X	X	
	Impact 3.2.1-7: Degradation of water quality due to elevated metals, endocrine disrupting chemicals, or other pollutants	X	X (Alt 2, 3)	
	Impact 3.2.4-1: Degradation of water quality due to release of contaminants and sediment from construction activities	X	X	X
Alternative 4	Impact 3.2.4-2: Degradation of water quality due to increased dissolved organic carbon (DOC) in Delta waters	X	X	X

Table 3.2-12: Summary of Water Quality Mitigation Applicability for Dutch Slough and Related Restoration Projects

	Mitigation	Dutch Slough Restoration Project	Related Projects	
			Ironhouse Project	City Community Park Project
Alternatives 1, 2, 3	Mitigation 3.2.1-1.1: Storm water pollution prevention plan	X	X	X
	Mitigation 3.2.1-1.2: Dewatering restriction	X	X	X
	Mitigation 3.2.1-1.3: Contractor training for protection of water quality	X	X	X
	Mitigation 3.2.1-1.4: Minimize potential pollution caused by inundation of site	X	X	
	Mitigation 3.2.1-2.1: Refine model for export and transport of TOC and DOC prior to initiating tidal flow.	X	X	
	Mitigation 3.2.1-2.2: Phase restoration of parcels	X	X	
	Mitigation 3.2.1-3: Dredge Little Dutch Slough	X	X	X
	Mitigation 3.2.1-4: Potential prohibition of diversion of Marsh Creek onto Ironhouse or Emerson parcel	X	X	
	Mitigation 3.2.1-7 Marsh Creek water quality testing and evaluate feasibility of Marsh Creek relocation based on water quality considerations	X	X	